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VOL. 28. Ser. A. Part 2. pp. 41–88. FEBRUARY, 1940.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

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BRENY (R.). **Élevage du doryphore en période hivernale.**—*Bull. Ann. Soc. ent. Belg.* **79** pt. 4–5 pp. 216–218, 1 ref. Brussels, 1939.

A description is given of a method that was successfully used in Belgium in 1939 for rearing *Leptinotarsa decemlineata*, Say, during the winter months. The eggs, larvae and adults were kept at temperatures of 20–29°C. [68–84·2°F.], 15–26°C. [59–78·8°F.] and 27–29°C. [80·6–84·2°F.], and relative humidities of 75–90, 40–55 and 40 per cent., respectively, and the eggs and adults were continuously exposed to artificial light. The method differed from that of Kozlovsky [*R.A.E.*, A **25** 650] chiefly in the treatment of the adults. The individuals used were taken from the soil on 3rd January, and if given access to soil, they burrowed into it even though it was perfectly dry. A technique was therefore adopted in which they were confined in glass cylinders 40 cm. high and 20 cm. in diameter, covered with fine mesh metal gauze and standing on a wooden table. There was a layer of earth 0·5 cm. thick at the bottom of each container. Young potato shoots, held in jars of water by means of cotton-wool, were supplied as food. The adults remained in an active state, pairing was frequent and oviposition satisfactory, 3,514 eggs being obtained from 6 pairs in a month. The eggs, nearly all of which were laid on the potato foliage, hatched in 3–6 days.

SCHWERDTFEGER (F.). **Ein neuer Feind der Douglasie ?** [A new Pest of Douglas Fir ?]—*Dtsch. Forstwirt* 1939 no. 49 repr. 2 pp., 2 figs. Berlin, 1939.

Infestation of Douglas fir [*Pseudotsuga taxifolia*] by *Chermes* (*Gilletteëlla*) *cooleyi*, Gill., occurs in widely separated localities in Germany, though its economic importance is uncertain. It was observed in the south-west in 1933 [*R.A.E.*, A **23** 524] and in Mecklenburg in 1938, while in 1939 the author found it in several localities in Brandenburg. Development of the winter forms is resumed about the end of March and is completed after three moults. At the end of May and early in June 1939, eggs and nymphs in the first, second and even third instar were present on the trees, but the adults of the winter generation were all dead. Most of the nymphs migrate to the developing May shoots, and if they are numerous, their feeding causes the needles to become yellow and deformed. It is not known whether this summer generation is followed by a second generation of aestivales or by the winter forms [*cf.* **24** 792].

JANCKE (O.). **Ein für Deutschland neuer Erdbeerschädling und seine Bekämpfung.** [A Strawberry Pest new for Germany and its Control.]—*NachrBl. dtsch. PflSchDienst* **19** no. 8 pp. 75–77, 11 refs. Berlin, 1939.

Observations in the Rhine Palatinate showed that much of the injury to strawberries that has been attributed to *Anthonomus rubi*, Hbst., is due to another weevil, *Rhynchites germanicus*, Hbst., which is widely distributed in the Rhineland and has been recorded from strawberry in England, where its biology has been studied [*R.A.E.*, A **24** 684], and Hungary [**25** 337]. The stems of individual blossoms, of entire blossom clusters and also of the leaves are so pierced with punctures that only a few fibres remain, and in most cases the blossoms

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or leaves hang down, wither and drop off. The injury to the blossoms may cause crop losses ranging up to 80–90 per cent. An account is given of field tests in 1937 and 1939 on the control of the weevil, which showed that several proprietary dusts of derris were more effective than mixtures of derris and pyrethrum. In laboratory tests, the percentage mortalities given by dusts containing derris, nicotine and pyrethrum were 100, 60 and 0.

ZACHER (F.). **Die Dörrobstmotte als Schädling in Lebensmittelhandel und Industrie.** [*Plodia interpunctella* as a Pest in the Foodstuff Trade and Industry.]—*Dtsch. Lebensmitt.-Rdsch.* 1939 no. 9 repr. 4 pp., 5 figs. Stuttgart, 1939.

For some years, the infestation of stored products by *Plodia interpunctella*, Hb., has been increasing in Germany, especially in factories making coffee substitutes and chocolate ; the larvae are also common in the raw materials of the oil and margarine industry and of the drug trade.

All stages of the Pyralid are described, and a list is given of the substances in which the larvae have been found, followed by a preliminary account of observations on its life-history [*cf. R.A.E.*, A **26** 460]. The egg stage lasted 10, 8, 4–5 and 2·5 days at 18·2, 19·2, 25 and 28–29°C. [64·76, 66·56, 77 and 82·4–84·2°F.]. The eggs developed at temperatures above 32°C. [89·6°F.], but did not hatch. The young larvae wandered without regard to the direction of the light until they found suitable food. They moulted 5 times during development, and then ceased feeding and wandered again for varying periods, sometimes travelling several hundred yards. During this time, they avoid light, and cover the sacks and walls of the store room with thick webs. There were marked individual differences in the duration of development of larvae that hatched from a given batch of eggs and were reared on the same food. On walnuts, which are the most favourable medium, the period from hatching to the second wandering lasted about 35, 60 and 90 days at 26, 18 and 17°C. [78·8, 64·4 and 62·6°F.]. The wandering continued for 3 days at 28°C. and 10–12 days at 18°. The pupal stage lasted 6–8 and about 30 days at 26 and 18°C., respectively. There are 1–3 generations a year in unheated warehouses, and 4–6 in heated ones.

The adults paired soon after emergence, and at 26°C. females began ovipositing on the same day. The average numbers of eggs laid by females from larvae fed on walnuts and maize and by those fed on sugar solution and starved averaged 430, 300, 342·8 and 102·7, respectively. The highest individual number (591) was deposited by a female that was fed on sugar solution and had developed from a larva fed on maize. Oviposition occurred at temperatures between 14 and 32°C. [57·2 and 87·8°F.].

The adults survived for about 3 and 10–11 days at 28–29°C. and relative humidities of 38 and 65 per cent., respectively. At an average temperature of about 19°C. [66·2°F.] and 5–10 per cent. humidity, the males lived for up to 9 days and the females for up to 16. Both sexes lived for over 16 days at 60 per cent. humidity, but died within 12 days at 95 per cent. The optimum temperature for development was 26–29°C., but the greatest increase in population occurred at about 20–24°C. [68–75·2°F.]. Short spells of high temperature favour oviposition and sometimes lead to the mass infestation of store rooms.

The reproductive capacity of females is reduced by winter temperatures of 16–17°C. [60·8–62·6°F.] and below. The eggs deposited by females that emerged in December–February were sterile, even if pairing had occurred, and this is considered to be due to the fact that on Sundays the temperature had been allowed to fall to 4–5°C. [29·2–41°F.], which affected the larvae. The males from these broods were normal. Adults did not survive exposure for 30 minutes to 44–45°C. [111·2–113°F.], and died immediately at 47°C. [116·6°F.]. Adults from larvae kept at 26°C. were more heat-resistant than those bred at room temperature.

The author found that 50 per cent. of the infestation of finished confectionery was due to *P. interpunctella*, most of the rest being due to *Ephestia cautella*, Wlk., which is often introduced with the raw cacao. The eggs of *P. interpunctella* are easily killed by a spray containing 1 per cent. of soft soap, and the larvae by one of pyrethrum containing 0·01 per cent. pyrethrins. A number of commercial atomised sprays are effective against the adults, but do not kill all the larvae [*cf.* **24** 191].

ZACHER (F.). **Schädlingsverbreitung und Nahrungsmittelhandel.** [The Spread of Pests and Trade in Foodstuffs.]—*Dtsch. Lebensmitt.-Rdsch.* 1939 no. 9 repr. 4 pp., 9 figs. Stuttgart, 1939.

Several well-known instances are cited of the spread by world trade of pests infesting fruit, vegetables and foodstuffs, with notes on the attendant conditions, and importers are urged to keep a watch to prevent further foreign pests from entering Germany.

NARAYANAN (E. S.) **"Auto-parasitism" by** *Nemeritis canescens* **(Grav.) (Ichneumonidae).**—*Nature* **144** no. 3639 p. 207. London, 1939.

Females of *Nemeritis canescens*, Grav., an Ichneumonid normally parasitic on *Ephestia kuehniella*, Zell., have been observed to oviposit under laboratory conditions in pupae of their own species, a phenomenon believed not to have been previously recorded in any insect parasite. The females reproduce parthenogenetically and oviposit half an hour after emergence. When reared on fully grown host larvae in a jar, the parasites do not emerge together, and those that emerge first try to oviposit in those that are still in the pupal stage. They succeed in laying one or more eggs if the ovipositor pierces the soft ventral side of the abdomen of the pupa in its cocoon. The larvae that hatch from these eggs undergo part of their development in the abdomen of their hosts, which, however, develop to adults and may live for some days after emergence.

About 40 advanced pupae of *N. canescens* were exposed in a jar to two adults of the same species for six hours; 25 adults emerged from them, and in the abdomen of two of these, dead, partly developed larvae were found. A higher percentage of parasitism occurred when the jar contained 80–100 pupae of *N. canescens*, since batches of 10–20 parasites emerged at intervals of 12–24 hours, and the number seeking hosts was therefore greater.

Superparasitism by *Nemeritis* commonly occurs in larvae of *Ephestia*, and was also observed to take place in *Nemeritis*, but whereas only

one parasite reaches the second instar in a larva of *Ephestia*, two larvae, one in the second and the other well advanced in the third instar, were observed in an adult of *Nemeritis*.

SQUIRE (F. A.). **A Note on Hosts of the Pink Bollworm,** *Platyedra gossypiella* **(Saund.), in the West Indies.**—*Emp. Cott. Gr. Rev.* **16** no. 3 pp. 194–196, 1 ref. London, 1939.

The secondary food-plants of *Platyedra gossypiella*, Saund., in the West Indies were investigated between 1936 and 1939. Practically all the West Indian representatives of 4 families were examined, but no new food-plants were found. The known ones are cottons (*Gossypium* spp.), *Hibiscus esculentus*, *H. abelmoschus*, *H. rosasinensis* (and other cultivated species of *Hibiscus*), *Althaea rosea*, *Thespesia populnea* and *Montezuma speciosissima*. *Gossypium* occurs in all the islands in either a wild or cultivated state, though it is not thought to be indigenous. The cultivated cotton is controlled by legislation, but the wild forms provide food for the bollworm from September to April. Wild cotton has, however, been eradicated from most of the islands where cotton is cultivated. *Hibiscus esculentus* is widely cultivated in nearly all the islands, particularly Barbados, where it is an important food crop, and the establishment of a close season would be difficult. It becomes heavily infested when near infested cotton, but the bollworm population drops to a low level when the cotton is destroyed. Of some 4,600 capsules examined in Barbados 3 months after the beginning of the close season for cotton, 0·09 per cent. were infested. It appears, therefore, to be able to carry over a very slight infestation without the aid of another food-plant, and a close season of 6 weeks coinciding with the latter part of the close season for cotton has been recommended. *Thespesia populnea* is widely distributed, but is only slightly infested even in the presence of heavily infested cotton, and has been observed to become free from infestation soon after the cotton is destroyed. In laboratory experiments, *P. gossypiella* oviposited readily on capsules of *Thespesia*, and newly-hatched larvae had little difficulty in penetrating the comparatively hard epidermis, but the tunnels ended in the subcutaneous tissue. It is therefore concluded that some toxic or repellent substance is responsible for its high resistance to attack. *Montezuma speciosissima* does not occur in the British West Indies, but is common in Porto Rico, where considerable infestations have been recorded. These were, however, probably due to the presence of infested cotton. Only very isolated instances of infestation were observed on the other food-plants. It is concluded that a distinction should be drawn between food-plants, such as cotton, that can support infestation independently and those that can do so only in the presence of heavily infested cotton and are unimportant where thorough clearing of cotton is followed by a three months' close season.

HUTSON (J. C.). **Some Suggestions for the Control of the Citrus and Mango Fruit-fly** (*Dacus ferrugineus*).—*Trop. Agriculturist* **92** no. 5 pp. 281–287. Peradeniya, 1939.

Dacus ferrugineus, F., is usually numerous in plantations of *Citrus* and mango in Ceylon during the fruiting season, but its presence is seldom detected until the fruit begins to rot on the trees or falls prematurely, when no control but the regular collecting and destroying

of fallen fruit is possible. The females usually begin to oviposit in fruits such as oranges, grapefruit and mangos just before they begin to ripen. The eggs, which are laid inside the fruits, hatch within a week. The larvae tunnel in the fruit for 1–2 weeks, and then drop to the ground and pupate about 2 ins. below the surface. Those emerging from fallen fruit pupate in the soil under or near the fruit. Males and females emerge in approximately equal numbers after 1–2 weeks. Oviposition is sometimes delayed for a month or more after adult emergence, and since the females require food before they pair or deposit their eggs, they can be destroyed before they oviposit by means of a poison bait consisting of 2 oz. sodium fluosilicate or lead arsenate powder and 2 lb. sugar in 4 gals. water.

The time to use poison bait can be ascertained by hanging in the trees two or three jars, filled to two-thirds of their capacity with water into which about ten drops of citronella oil is poured. These attract the males and should be exposed as soon as the earlier fruits are half-ripe. It is advisable to suspend a cover about 2 ins. above each jar to protect it from heavy rains, and the liquid should be renewed twice a week during dry weather and once a week during wet weather. The lure of vanilla essence, ammonia and water recommended in New South Wales [*R.A.E.*, A **22** 88] has not proved successful in Ceylon. There may be two periods of prevalence during the year, corresponding with the fruiting seasons of *Citrus* and mango and varying in different districts. The use of poison bait should begin when 12 males per jar are caught weekly for two or three weeks in succession, or, if the jars are not used, about six weeks before the earlier fruits are expected to ripen, and should be continued until the end of the season. Tins for the bait are prepared by cutting 6 slits in the top and bending outwards alternate pieces between the cuts to form 3 horizontal flaps. About 3 oz. bait is placed in each tin, and in it are dipped the ends of strips of cloth or lamp-wick that extend slightly beyond the edges of the flaps. The tins should be covered and hung in the trees ; about 24 are required per acre. They should be renewed when they become rusty and refilled when necessary. The bait can also be sprinkled in large drops on the trees themselves or on bunches of twigs or bundles of straw hung in them. If used in this way, it should be applied during the late afternoon in fine weather, 2–3 times a week in the early part of the season and once a week later, and the application should be repeated after heavy rain. The trees should be sprinkled in rotation, about a third at a time. About 1 gal. of bait is required for 24 trees. In heavily infested orchards, one-third of the trees should be baited with tins and at least another third should be sprinkled with the bait periodically in rotation for 2–3 weeks.

Experiments at Peradeniya showed that enclosing grapefruit in bags prevented attack by *D. ferrugineus*, and unprotected fruit was usually heavily attacked. The cost of baiting in tins or by sprinkling and of bags for the protection of the fruit is discussed. All attacked and fallen fruit should be collected and destroyed daily, whether other control measures are employed or not.

Evans (J. W.). **Insect Pests of Currants, Raspberries and Gooseberries.** —*Tasm. J. Agric.* **10** no. 2 pp. 87–90, 3 figs. Hobart, 1939.

Notes are given on the bionomics of the four insect pests that attack bush fruits in Tasmania, together with very brief descriptions of the adults of each.

Adults of *Aegeria tipuliformis*, Clerck, emerge during November and December, and females deposit 20–60 eggs on the young wood in cracks in the bark and in the axils of leaves and buds of currant, especially black currant, and gooseberry bushes. The larvae hatch in about 12 days, bore in the pith of the stems, occasionally reaching the roots, and pupate in their mines in the following spring. Severely infested bushes are sometimes killed. The only available means of control is the removal, while the plants are dormant, of infested shoots and branches, or, if necessary, the destruction of the whole bush.

The leaves of many cultivated plants, including various fruit trees and raspberry, are skeletonised by adults of the native Melolonthid, *Diphucephala colaspidoides*, Gylh., which appear in large numbers in December, especially on light, sandy soil. The larvae, which are not injurious, feed on the roots of wattle (*Acacia*) and other trees, and the life-cycle is believed to last four years. In raspberry plantations, the beetles may concentrate on a few canes or be widely scattered, and infestation is sometimes of only short duration. The best control is afforded by shaking them from the canes into water containing kerosene. This should be done in the morning, when they are inactive. Smudge fires are of some value as repellents if the wind is favourable.

The Coccid, *Lecanium coryli*, L., infests gooseberry, currant, raspberry and other plants. Eggs are deposited in large numbers during November and early December, and the nymphs hatch from December until early March. They overwinter on wood of the previous year's growth, and can then be destroyed by means of oil sprays.

The branches of gooseberry and currant bushes are sometimes killed by the slits cut in them for oviposition by the Cicadid, *Melampsalta torrida*, Erichs., which is not a serious pest, but is abundant in some seasons. As many as eight slits may be made in a branch by a single female. Affected branches can be distinguished by the bundles of fibres that project obliquely from the wood, and should be removed. The nymphs, which are not injurious, fall to the ground on hatching and feed on roots.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **50** pt. 5 pp. 277–280, 5 figs. Sydney, 1939.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **27** 639] includes notes on the life-history of *Microphanurus basalis*, Wollaston, the introduced Scelionid egg parasite of *Nezara viridula*, L. [*cf.* **25** 737]. It was recovered in the field in 1937, 1938 and 1939, and is known to be established in three districts. It was reared in large numbers in the insectary from stocks collected in the field in 1937–39 and liberated in various localities. Consignments were also sent to Canberra, Queensland, Victoria and Lord Howe Island.

A South African Dynastid, *Heteronychus sanctae-helenae*, Blanch., is now well established on the coast of New South Wales. The adults bore into the stems of young maize, sugar-cane and vegetables just below the surface of the soil, making irregular holes, which weaken and usually kill the plants. They also bore into the turf of bowling greens and golf courses and produce irregularities on the surface. The greatest damage is usually caused by the overwintered adults, which attack maize from August to October. Egg-laying continues until the end of October, chiefly in low-lying *Paspalum* country. The

larvae pass some months in the soil, where they pupate. The beetles emerge from the soil in February and March. In 1939, newly emerged adults completely destroyed newly planted cauliflowers and tomatos, and were particularly numerous on ground on which maize had been grown previously. The beetles do not usually fly, but are able to do so and appear to be attracted to certain lights, such as blue mercury street lights and Neon signs.

Sugar-cane setts can be protected satisfactorily by dipping them into a mixture of 1 lb. lead arsenate powder, ½ lb. glue and 1 gal. water. Maize should be sown at such a time that the beetles are not present during the period of early growth. Crops sown in November escape attack by the overwintered adults. Some protection of growing plants has been obtained by jetting them at the base with a suspension of 1 lb. lead arsenate powder in 30 gals. water, applied in November, with sufficient force to penetrate 2–3 ins. into the soil. Wrapping the stems of the young plants in paper is also reported to give some protection, but is impracticable for large plantings. Preliminary tests with baits of poisoned bran, lead arsenate dips and whitewash gave unsatisfactory results. Vegetable crops are probably infested chiefly because they are planted in virgin grass country that is already infested, and thorough preparation of the ground and cultivation to keep it free from weeds would reduce the infestation. Beetles can be prevented from migrating to crops from *Paspalum* by a furrow, with the side nearest the crop vertical. Holes are dug at intervals along the furrow, in which the beetles collect, and they can then be destroyed. They can also be trapped under heaps of grass placed in the fields.

NOBLE (N. S.). *Tepperella trilineata* **Cam., a Wasp causing Galling of the Flower Buds of** *Acacia decurrens*.—*Proc. Linn. Soc. N.S.W.* **63** pt. 5–6 pp. 389–411, 1 pl., 9 figs., 9 refs. Sydney, 1938. [Recd. 1939.]

This paper comprises a detailed account of observations in New South Wales on the complex of insects associated with severe galling of the flower buds of an old tree of *Acacia decurrens* var. *pauciglandulosa*, which eventually died. The galls were caused by the Perilampid, *Tepperella trilineata*, Cam. ; and an unidentified species of *Eurytoma* and another of *Megastigmus*, which were numerous, and seven other Chalcidoids were also reared from them. In addition, limited numbers of a Bethylid and a Braconid, both considered to be parasitic on Lepidopterous larvae mining in the galls, were obtained. Descriptions are given of the development of the galls, and of all stages of *T. trilineata* and its life-history. The egg, larval and pupal stages lasted about 4, 42 and 6 weeks, respectively, and the adults survived only 5–6 days.

PESCOTT (R. T. M.). **The Cabbage Butterfly** (*Pieris rapae* **L.**).—*J. Dep. Agric. Vict.* **37** pt. 5 pp. 218–219, 3 figs., 1 ref. Melbourne, 1939.

Two adults of *Pieris rapae*, L., were caught in the grounds of the University of Melbourne and at Canterbury in March 1939. This is the first record of the species from Victoria, and probably also from Australia. An account based on one already noticed [*R.A.E.*, A **14** 408] is given of its bionomics and control, all stages are described, and growers of cruciferous crops are asked to report its occurrence.

JOHNSTON (C. J. R.) & HOGAN (T. W.). **Red Scale of Citrus. Second Progress Report.**—*J. Dep. Agric. Vict.* **37** pt. 5 pp. 242–256, 3 figs., 6 graphs, 2 refs. Melbourne, 1939.

This report on work during 1936–38 on the bionomics and control of *Aonidiella aurantii*, Mask., on *Citrus* in Victoria [*cf. R.A.E.*, A **26** 85] contains accounts of field studies on the seasonal composition of populations and the fluctuation of natural mortality of the Coccid on untreated trees in northern Victoria, field trials to determine the strength and season at which oil emulsions should be applied and fumigation with hydrocyanic acid gas carried out, and trials of a schedule comprising an oil emulsion spray followed by fumigation [*cf.* **27** 292]. The results of all the trials are given in graphs and tables. The effect of the dosage rate on the concentration of gas produced during fumigation is discussed, and graphs and tables show the concentrations produced at different positions within the fumigation tents, the mean concentration in each month, and the meteorological conditions prevailing on the nights on which the tests were performed.

The following is based on the authors' summary: The natural mortality on untreated trees rose sharply in April 1937 and reached a maximum between 1st July and 30th September, when a predacious Coccinellid was active. Reproduction started again in October and considerably reduced the percentage mortality figure by the end of that month; it continued much later into the autumn in 1938 than in 1937, owing to abnormally high temperatures during March–June. Under such conditions, Coccids that survive spring and summer treatments may cause considerable damage to crops of Valencia oranges.

In spraying experiments, a schedule comprising two applications of a white-oil emulsion at the standard concentration (1 : 40 in December and March gave a significantly higher percentage of clean fruit (76·8) in 1936–37 than one in which the second application was made in January (57·2). The results from single applications made in December and March, respectively, in 1935–36 and again in 1936–37 indicated that autumn sprays have a high control value, which becomes apparent only on the crops produced during the subsequent season. In 1936–37, schedules comprising four applications, in December, January, March and April, of spray at concentrations of 1 : 80 and 1 : 67, designed to destroy the immature stages, gave 86·8 and 88·7 per cent. clean fruit, respectively, on trees that were heavily infested before treatment. A spray at standard concentration in February 1937 followed by a second application between March and August, inclusive, gave satisfactory mortality on leaves (99·5–99·9 per cent.) but not on fruits (86·2–92·4 per cent.), which, in the case of Valencia oranges, remain on the tree until December and constitute a source of reinfestation.

When the standard rate of application of calcium cyanide in the form of Calcid briquettes for trees shown by the summer chart to require six tablets was increased by 17 or 67 per cent., the mortalities afforded were not significantly higher than those given when it was reduced by 33 per cent. The highest rate produced 100 per cent. higher concentrations of hydrocyanic acid gas than the lowest, but caused no damage to the trees or the crop. No variation from the standard Calcid chart doses is recommended. An average monthly percentage mortality of 98·8 was obtained on fruit following fumigation during March, April and August and of 98·6 on leaves after treatment

in these months and in February. Fumigation in bright sunlight in late June and in August was successful and safe to trees and crops in preliminary trials in northern Victoria when the soil moisture content was fairly high, but after August, when the air temperature is high and the soil dry, or if the physiological condition of the trees is poor, it is attended by risk. High wind is the most important single factor preventing satisfactory control, and it reduces the gas concentration more rapidly under hot dry atmospheric conditions than when the humidity is high. A satisfactory percentage of uninfested fruit cannot be obtained from heavily infested trees unless they are fumigated before 1st February in average years, since after this period, large numbers of Coccids reach maturity, and very few drop off before harvest. For trees with a low Coccid population, autumn fumigation has advantages over summer treatment. In 1937, schedules comprising a single application of white-oil emulsion at the standard concentration in February, followed by fumigation with Calcid at the rate of 117 per cent. standard chart dose in February, March, April or August, gave average mortalities of 99·9 per cent., irrespective of the intervals between the treatments, but the proportion of clean fruit at harvest was low. The effect of the August treatment on Coccid control was evident on the 1938 crop; the same programme was repeated in 1938, and complete freedom from living Coccids was expected on some trees at harvest.

COTTIER (W.). **Citrus Pests : (7) Scale Insects. Unshielded Scales. The Cottony Cushion Scale and the White Wax Scale.**—*N. Z. J. Agric.* **58** no. 5 pp. 421–422, 2 figs. Wellington, N.Z., 1939.

This paper, which belongs to a series [*cf. R.A.E.*, A **27** 523], contains brief notes on the morphology, bionomics, distribution and food-plants of *Icerya purchasi*, Mask., and *Ceroplastes sinensis*, Del G., which infest *Citrus* in New Zealand.

I. purchasi has two generations a year and overwinters in the immature stages. Adequate control is usually maintained by the imported Coccinellid, *Rodolia cardinalis*, Muls., but summer-grade oil (1 : 60) may be applied as a further measure. *Ceroplastes sinensis* was first observed in New Zealand in 1932 and has hitherto been erroneously recorded there as *C. rusci*, L., and *C. rubens*, Mask. [**22** 41]. It has one generation a year in New Zealand. Eggs are laid during January–February and most have hatched by early March; development continues slowly during winter and spring and is completed by December. The immature stages occur on the upper surfaces of the leaves, and the adults on the stems and small branches; honey-dew, with which sooty mould is frequently associated, is freely exuded. Summer oil (1 : 33) applied during March–April is recommended for control.

FROGGATT (J. L.). **The Coco-nut Leaf-miner** *Promecotheca papuana*, **Csiki** (*antiqua*, **Wse.**).—*New Guinea agric. Gaz.* **5** no. 1 pp. 3–10, 3 refs. Rabaul, 1939.

Infestation of coconut by *Promecotheca papuana*, Csiki, occurs sporadically in various parts of the Territory of New Guinea, but is usually worst in the parts where there is no definite dry period, and begins along the sea shore, spreading inland. At the end of 1937, there

was a severe infestation in the north of New Britain along a coastal strip about a quarter of a mile wide. Small localised infestations that occurred later along the roads leading inland were found to correspond with places where the natives, carrying produce to and from market, were accustomed to stop to rest or sell their produce, which they carried in baskets of plaited coconut foliage that were thrown into the undergrowth when empty. Many of these baskets were found to carry eggs or larvae of *Promecotheca*. The infestation was controlled by parasitism in May 1938.

The various stages of *P. papuana* are briefly described, and notes are given on its bionomics [*R.A.E.*, A **24** 466] and measures for its control. Mechanical methods include cutting off and burning infested fronds and collecting the adults, scorching the under-surface of the fronds [**26** 495], rubbing the egg masses off the leaves and crushing the larvae in the leaves of small palms [**26** 435], and placing fresh young fronds of any palms that may attract the adults, such as *Metroxylon sagu* and *Nipa fruticans*, upright among the coconut palms and destroying the beetles that come to rest on them. Insecticides suggested include sprays or dusts of lead arsenate, sprays of nicotine sulphate alone or in combination with the arsenical, and dusts of derris or cubé.

A Hymenopterous parasite of the larvae, found in 1930 and subsequently, was identified as a species of *Eurytoma* [*promecothecae*, Ferrière (**27** 506)]. This is the chief agent of natural control in New Britain. In the early stages of the 1937 outbreak, it was present in small numbers over the greater part of the outbreak area, but was numerous outside that area. It had increased considerably by March 1938 and had had a marked effect on the population of *P. papuana* over a large section by early April. Its natural increase was assisted by liberation of laboratory-reared adults. It bred readily in captivity, especially in second- and third-instar larvae. Mines containing larvae were exposed in glass tubes to the parasites, which were fed on slightly diluted honey or sugar syrup. The female punctures the upper surface of the mine with the ovipositor and deposits eggs on the outside of the host larva. The parasite larvae attach themselves to the body of the host larva and suck the contents until only the skin remains. There are usually 4–5 larvae of *Eurytoma* to each host. Pupation usually takes place at the site of feeding, the posterior end of the body of each pupa being attached to the wall of the mine. On emergence, the adults remain for a short time within the mine and then leave it through a hole that they cut in the leaf tissue. The life-cycle in the laboratory at Rabaul occupied 15–19 days, and the adults lived for 6–7 weeks. Other parasites that have been recorded in New Guinea Territory are the Eulophids, *Entedon* sp. and *Derostenus* sp., attacking the larvae, and *Closterocerus splendens*, Kow., attacking both larvae and eggs, and the Eupelmid, *Anastatus* sp., attacking the eggs. The Pentatomid, *Amyotea reciproca*, Wlk., has been found to be predacious on adults of *Promecotheca*, but is relatively scarce.

In 1936, the possibility of introducing *Pleurotropis parvulus*, Ferrière, from Fiji, where it had been successfully established for the control of *Promecotheca reichei*, Baly [**25** 191], was examined, but the project was not then practicable. Attempts to introduce it from the New Hebrides and from Fiji were made in 1938 [*cf.* **27** 366], but were not successful until September, when adults and pupae in mines of mature larvae of *Promecotheca* arrived alive from Fiji, having been sent in ship's cooler to Sydney where they were kept packed in ice and

whence they were immediately despatched by aeroplane to Rabaul. The first generation bred from these individuals was not so large as was hoped, but the second was satisfactory and liberations were begun within 8 weeks of the receipt of the original colony. The maximum life of the females was 21 days, and that of the males a few days less. The adults are very active and fed freely on slightly diluted honey. The females are strongly attracted to light. The life-cycle occupied 17–23 days. As many as 39 parasites emerged from a mine containing three *Promecotheca* larvae, and 79 from one containing four.

FROGGATT (J. L.). **Insect Pests of Rice.**—*New Guinea agric. Gaz.* **5** no. 1 pp. 16–18. Rabaul, 1939.

Rice has been planted in small areas in various parts of the Territory of New Guinea. A list is given of the principal pests attacking it in the Rabaul-Kokopo and Talasea districts, with brief descriptions of the adults and general recommendations on control. They include three bugs, *Leptocorisa* sp., *Nezara viridula smaragdula*, F., and *Phaenacantha* sp., which attack the seed heads and seeds, and the Halticid, *Aphthona bicolorata*, Jac., the weevil, *Exophthalmida rustica*, Faust, *Cirphis unipuncta*, Haw., a Pyralid of the genus *Marasmia*, and *Parnara cinnara*, Wall., which attack the leaves. The eggs of *Marasmia* are laid on the foliage, and the larvae roll the leaves into a tube in which they shelter and pupate. The larvae of *P. cinnara* web the leaves together and feed at night. They pupate in the webbed leaves. Considerable loss to stored rice is caused by *Corcyra cephalonica*, Staint., and *Ephestia cautella*, Wlk.

VAN DER LAAN (P. A.). **Dierkundige Afdeeling.** [Zoological Section.] —*Meded. Deli Proefst.* (3) no. 3 pp. 22–28. Medan, 1939.

Records are given of the occurrence of a number of the usual insect pests of tobacco in Deli, Sumatra, in 1938. Of several insecticides tested against the Aphid [*Myzus persicae*, Sulz.], a spray containing 0·2 per cent. derris powder (rotenone content of 10 per cent.) and 0·1 per cent. soap gave the best control and freed from infestation 97 per cent. of 3,510 tobacco leaves in one series and 99 per cent. of 2,898 leaves in another. Investigations indicated that tobacco and *Physalis angulata* were the chief, if not the only, food-plants of *Heliothis assulta*, Gn.

HARGREAVES (H.). **Report of the Senior Entomologist, Kampala.**— *Rep. Dep. Agric. Uganda 1937–38* pt. 2 pp. 7–9. Entebbe, 1939.

Nomadacris [*septemfasciata*, Serv.] spread into the Eastern Province of Uganda in September 1937 for the first time since 1918, and eggs were laid over considerable areas during the latter half of the month and in October. Hoppers began to appear in October and developed to adults in late December and January. A westerly movement began in January, and several swarms crossed the border into the Sudan. Those that remained moved eastward in April and broke up into smaller swarms. Eggs were laid in May and June, and in the latter month hoppers appeared in the more eastern districts. Injury to crops was generally slight, but there was intense local damage to cotton in late 1937 in an eastern district. In the west [*cf. R.A.E.*, A **26** 372], swarms entered from the south in May–July 1937, but the number observed decreased until June 1938, and breeding was very restricted.

Only the West Nile District was affected by *Locusta* [*migratoria migratorioides*, R. & F.]. A swarm entered from the Belgian Congo in January and returned the next day. Two swarms appeared in February and later flew north-west into the Sudan. In March, two swarms entered from the south, but they soon returned to Belgian territory. Several partly mature swarms flew north-east. Eggs were laid in April in rather widespread areas in the north, and small bands of hoppers hatched in May.

TAYLOR (T. H. C.). **Report of the Entomologist, Kampala.**—*Rep. Dep. Agric. Uganda 1937–38* pt. 2 pp. 9–10. Entebbe, 1939.

During 1937–38, the area of distribution of the pink bollworm [*Platyedra gossypiella*, Saund.] on cotton in eastern Uganda [*cf. R.A.E.*, A **26** 376] was extended, and reached the southern part of the Kenya border. It was again concluded that serious injury by this species is unlikely if the recommended control measures are rigidly enforced. However, in some areas, the destruction of old plants at the end of the season was not complete. In investigations in Kasilo county in March and April 1938, the resting stage was found to be of rare and abnormal occurrence, but it cannot be assumed that this is the case in all parts of Teso.

GWYNN (A. M.). **Report of the Entomologist, Serere.**—*Rep. Dep. Agric. Uganda 1937–38* pt. 2 pp. 10–19, 2 fldg. pls., 1 ref. Entebbe, 1939.

A heavy infestation of *Lygus* [*simonyi*, Reut.] occurred as usual on early-sown cotton in Teso District, eastern Uganda. It began to decrease in the latter part of August, and July-sown cotton suffered relatively little. In an experiment on the interplanting of cotton and ground-nuts, in which the cotton was planted a fortnight before, at the same time as, and a fortnight after the ground-nuts, its growth was severely checked in all plots as compared with the controls in which there were no ground-nuts and it showed much less damage by *Lygus* and much smaller *Lygus* populations. It is not, however, suggested that the difference in infestation would normally be sufficient to compensate for the loss of yield through decreased vigour. The combined results of investigations made over a period of three years indicated consistent differences in the susceptibility of various varieties of cotton to attack [*cf. R.A.E.*, A **26** 376]. Outbreaks of *Lygus* on cotton are caused by large invasions of adults, probably from *Eleusine* and *Sorghum*, which are harvested early in June, when the invasions begin, and which harbour heavy *Lygus* populations in their later stages.

Injury to cotton by *Helopeltis* [*bergrothi*, Reut.] was slight. In tests of varietal susceptibility, no significant differences were found when the number of plants attacked in each plot was used in the analysis of the results, but when the logarithm of the number plus one was used, significant differences were obtained. Infestation was late, and it appears that differences in varietal susceptibility are not so marked in late as in early infestations. Infestation by Jassids was much higher than in the previous two seasons at the Experiment Farm at Serere, probably owing to the cultivation of a susceptible variety, and the yield of a few plots was adversely affected, but in most other districts it was negligible. Varieties of cotton were shown to differ in susceptibility, but there was no indication that spacing had any influence on

the density of the Jassid population. The correlation between yield and Jassid infestation was worked out separately for each variety in the July sowing, and was in most cases highly significant. It is concluded that yield is affected by a much smaller Jassid population than had hitherto been supposed.

MARTELLI (G. M.). **Contributo alla conoscenza della** *Deilephila lineata* **F. var.** *livornica* **Esp. (Lepidoptera Heterocera).** [A Contribution to the Knowledge of *Celerio lineata* var. *livornica*, Esp.]—*Ann. Cent. sper. agrar. zootec. Libia* **1** (Pubbl. no. 3) repr. 34 pp., 5 pls., 6 refs. Tripoli, 1939.

Details are given of further investigations on the bionomics of the Sphingid, *Celerio* (*Deilephila*) *lineata* var. *livornica*, Esp., which caused considerable injury to vines in Tripolitania in 1937 [*cf. R.A.E.*, A **26** 201], together with descriptions of all stages and notes on its distribution.

The larvae do very little damage to the leaves of vines during the first instar, but in the later ones they defoliate the plants. They pass through 5 instars and pupate in the ground, usually at depths of 1½–2 ins. The adults, which are active in the evening, feed on nectar, but nutrition is not essential for pairing and oviposition. There were 3 generations in 1937, but as adults were observed as late as December in 1936 in a district in the interior, it is possible that there may be more there.

Descriptions are given of the origin and course of the outbreak in 1937 [*loc. cit.*], which is attributed to mass migration of the larvae. Polygonaceae are the preferred food-plants and those on which the eggs are usually laid, but if they are destroyed or become unsuitable the larvae readily attack grape-vines. When they have defoliated the vines, they pass to other plants, including olive. A list is given of the plants on which they were observed in Tripolitania. A south-easterly desert wind that blows intermittently and can raise the temperature to 50°C. [122°F.] and decrease humidity to 2–3 per cent. has a great influence on infestation. Its effects on the various stages of this Sphingid are discussed, and it is concluded that in 1937, a year in which conditions were fairly normal, it was favourable to the first generation and unfavourable to the second and particularly the third.

The only parasite observed was *Trichogramma evanescens*, Westw., which parasitised about 49 per cent. of the eggs of the second generation. Various beetles were predacious on the larvae, but none exercised any considerable control.

MARTELLI (G. M.). **La protezione delle arance dalla** *Ceratitis capitata* **Wied. (II. Esperienze col cellofane.)** [The Protection of Oranges against *C. capitata*. (II. Experiments with Cellophane.)]—*Ann. Cent. sper. agrar. zootec. Libia* **1** (Pubbl. no. 4) repr. 7 pp. Tripoli, 1939.

In further experiments in Tripoli in 1937–38 on methods of protecting the fruits of *Citrus* against *Ceratitis capitata*, Wied. [*R.A.E.*, A **26** 5], sheets of colourless, light blue and blue cellophane were wrapped round oranges on four trees in October, while they were still green, and tied to the stalks about an inch from the fruits. It was thought that the space enclosed would allow for the growth of the oranges, without being too large and so leading to abnormally high temperatures.

Infestation by the fly was in general heavy, and many of the unprotected fruits dropped. Some of the envelopes burst in February, after the main period of infestation, owing to rain and the growth of the oranges, and the coloured cellophane had lost its colour after 3 months. The protected fruits were not attacked, none dropped, and no scorching was observed. Ripening was delayed 8–10 days in all the wrapped fruits, but exposure to the air quickly improved their quality. It is suggested, therefore, that the envelopes should be removed at the appropriate time and used again in the following year, which would compensate for their relatively high cost.

MARTELLI (G. M.). *Lonchaea splendida* **Loew, parassita del peperone in Libia.** [*L. splendida*, a Pest of *Capsicum* Peppers in Libya.]—*Ann. Cent. sper. agrar. zootec. Libia* **1** (Pubbl. no. 8) repr. 4 pp. Tripoli, 1939.

Fruits of peppers (*Capsicum annuum*) from Tripoli were found to be infested by *Ceratitis capitata*, Wied. [*cf. R.A.E.*, A **26** 260], and also by *Lonchaea aurea*, Macq. (*splendida*, Lw.), which has not previously been recorded from peppers in Tripolitania. The larvae of both species often occurred together in a single fruit. The eggs of *L. aurea* are laid in partly developed fruits. Nearly all peppers are attacked, especially the highly pungent native varieties and the sweet Italian ones. The larvae feed inside the fruit, sometimes injuring the seeds. They generally pupate in the soil, but occasionally do so in the fruits. From a few to over a thousand larvae may be found in a single fruit. There appear to be 3 or more generations a year, hibernation occurring in the pupal stage. The glass traps containing a bait of ammonia and water in which bran has been fermented that are used against *C. capitata* were often found to attract adults of *L. aurea*, chiefly females.

HARPER (S. H.). **The active Principles of leguminous Fish-poison Plants. Part I. The properties of *l*-α-Toxicarol isolated from *Derris malaccensis* (Kinta Type).**—*J. chem. Soc.* 1939 pp. 812–816. London, 1939.

The following is the author's summary: The optically active precursor of toxicarol [*cf. R.A.E.*, A **26** 616, 631] has been obtained by direct crystallisation of an ethereal extract of *Derris malaccensis* (Kinta type). After being freed from a small proportion of sumatrol by the method of Cahn, Phipers & Boam (1938), the *l*-α-toxicarol was identical in properties with that described by Tattersfield & Martin (1937). It is concluded that the optical data of Cahn, Phipers & Boam are untrustworthy, and their criticism of Tattersfield & Martin unjustified.

FEYTAUD (J.). **A propos des dégats de la galéruque de l'aulne sur les arbres fruitiers.**—*C. R. Acad. Agric. Fr.* **25** no. 22 pp. 787–790. Paris, 1939.

A Galerucid that had been attacking fruit trees in various parts of the department of Landes in south-western France was identified in April 1939 as *Agelastica alni*, L. The beetles had been observed in some places as early as 20th March, but injury by them began about 10th April and continued through early May. In various districts,

pear, apple, plum, hazel [*Corylus avellana*], cherry and rose trees, and to a slight extent, vines, were infested. In some cases, flower buds and flowers were destroyed before the leaves were attacked. *A. alni* is usually considered to be restricted to alder, willow and birch [*R.A.E.*, A **23** 392], though it attacked vines in France in 1907 and defoliated cherries in Germany in 1933 [**22** 248]. Control was effected by arsenical sprays, and preparations containing rotenone [*cf.* **23** 256] and pyrethrum also gave good results. The change of food-plant is attributed to disproportion between the numbers of adults emerging from hibernation and the available alder.

GHESQUIÈRE (J.). **Observations sur** *Ceratitis capitata* **Wied. en Belgique.** —*Bull. Ann. Soc. ent. Belg.* **79** no. 6 pp. 235–236, 6 refs. Brussels, 1939.

On 24th December 1938, 14 fully developed but sluggish larvae of *Ceratitis capitata*, Wied., were found in Brussels in Algerian mandarin oranges that had been subjected to a minimum atmospheric temperature of −11°C. [12·2°F.] and an internal temperature of about 0°C. [32°F.]. The temperature of the fruit was gradually raised to 22°C. [71·6°F.], and 4 of the larvae pupated on 26th, the other 10 dying before 28th. The pupae were kept at an average temperature of 14°C. [57·2°F.] only, and 2 males and 2 females emerged on 26th January. M. Goetghebuer recorded the finding of *C. capitata* in Belgium in 1925. Instances are given of its survival in France [*R.A.E.*, A **22** 118] and Switzerland [**24** 360 ; **25** 660], and attention is drawn to the possibility of its becoming established in Belgium if accidentally introduced.

SCHNEIDER-ORELLI (O.). **Ueber das Vordringen der gefährlichen Weisstannenlaus** *Dreyfusia nüsslini* **im Plenterwaldgebiet Vorderarni.** [The Advance of the dangerous Silver Fir Aphid, *Chermes nordmannianae*, in the Selection Forest District of Vorderarni.]—*Schweiz. Z. Forstwes.* 1939 no. 7–8 repr. 5 pp., 1 fig., 1 pl. Bern, 1939.

Details are given of the infestation in 1938–39 of silver fir [*Abies*] on the slopes in a forest district in Emmental, Switzerland, by *Chermes* (*Dreyfusia*) *nordmannianae*, Eckstein (*nüsslini*, Börner), which had not been present in the area in the years 1926–33. The infestation has increased very rapidly, and not only young growth but also old trees, including one 150 years old, are attacked [*cf. R.A.E.*, A **25** 659]. In one locality, numerous larvae of the Coccinellid, *Aphidecta obliterata*, L., were observed preying on the Aphids.

FOERSTER (H.). **Gregarinen in schlesischen Insekten.** [Gregarines in Silesian Insects.]—*Z. Parasitenk.* **10** no. 2 pp. 157–209, 70 figs., 2 pp. refs. Berlin, 1938. [Recd. 1939.] **Beobachtungen über das Auftreten von Gregarinen in Insekten.** [Observations on the Occurrence of Gregarines in Insects.]—*T.c.* no. 5 pp. 644–673.

EICHLER (W.). **Gregarinen als Feinde von Vorratsschädlingen.** [Gregarines as Enemies of stored-product Pests.]—*Mitt. Ges. Vorratsschutz* **15** no. 4 pp. 48–50, 2 refs. Berlin, 1939.

In the first two papers, the author gives the results of the examination of over 600 species of insects taken in German Silesia with a view to

determining their Gregarine parasites; 188 species were found infested, and 88 Gregarines, 20 of which are described as new, were observed. The third paper is based on the other two and comprises notes on infestation by Gregarines of pests of stored products.

Erler (E.). **Beobachtungen zur Oekologie und Bekämpfung des Eichenwicklers** (*Tortrix viridana* **L.**) **in Westfalen.** [Observations on the Ecology and Control of the Oak Tortrix in Westphalia.]—*Anz. Schädlingsk.* **15** pt. 8 pp. 85–93, 8 figs. Berlin, 1939.

This first part of a paper on *Tortrix viridana*, L., comprises an account of observations on its bionomics and natural enemies in Westphalia. It attacks oaks throughout Europe in regions that differ very considerably in climate, possibly because its development is completed within 3 months and during the rest of the year the eggs are protected against unfavourable conditions. In Germany, Westphalia and the region of the Lower Rhine are the areas most affected; infestations that cause defoliation occur almost every year. In view of the unusually severe injury in the forestry district of Münster, Westphalia, in 1937, investigations were carried out from April to July 1938, chiefly in stands of oak 60–80 years old with a lower growth of hornbeam, such as are typical in Westphalia. The results are compared with those of other authors, principally Gasow [*R.A.E.*, A **13** 395; **14** 33].

The eggs are laid in pairs and usually overlap slightly. It is impossible to forecast larval populations by counting the eggs, as they are covered by a cement that soon becomes coated with dust and algae and effectually conceals them. They are usually deposited on the uneven bark of the forks in the upper half of the tree crown, and feeding therefore begins at the top of the tree. On 21st April, when the observations began, most of the larvae had entered the leaf buds, and very few eggs were still present on the trees. During the third instar the larvae roll or fold the leaves. Larval feeding was estimated by collecting excreta, and was greatest during the fourth and fifth instars. A table is given of the head-capsule measurements of larvae of the five instars. Pupation began on 2nd June, and very few larvae were to be found five days later. They usually pupated in leaf-folds, and only rarely in cracks in the bark. The first adults were seen on 17th June, and the main flight occurred from 25th to 29th June. Foresters reported that the adult population in 1938 was only about one-tenth of that in previous years, and the author attributes this to heavy pupal mortality. About 45–50 per cent. of the pupae examined were parasitised.

The parasites observed were the Ichneumonids, *Pimpla maculator*, F., which was the most abundant, *Phaeogenes stimulator*, Grav., *Blaptocampus nigricornis*, Wesm., and *Bassus laetatorius*, F., which was rare. Some parasitism by Tachinids also occurred. The larvae were destroyed by birds, and the pupae by the predacious Carabid, *Calosoma inquisitor*, L., which was fairly common in the upper parts of the trees. The oaks were not defoliated in 1938, probably because warm weather in early spring caused the eggs to hatch very early, and subsequent cold weather checked the development of the first-instar larvae and delayed the growth of the oak foliage so that larval mortality was high. All species of oak were attacked indiscriminately.

Villeneuve de Janti (J.). **Une nouvelle espèce du genre *Blaesoxypha* parasite des sauterelles en Italie.**—*Boll. Soc. ent. Ital.* **71** no. 6–7 pp. 114–115. Genoa, 1939.

Paoli (G.). **Ditteri endofagi delle cavalette di Foggia.** [Diptera parasitic on Grasshoppers in Foggia].—*T.c.* pp. 116–118.

In the second paper, a list is given of six Sarcophagids parasitising *Dociostaurus maroccanus*, Thnb., in the Foggia province of Italy [*R.A.E.*, A **26** 162]; they include *Blaesoxipha paolii*, Villen., which is described as new in the first paper. References are given to previous records of these and other species parasitising Acridids in Italy. *Muscina stabulans*, Fall., was bred from a dead example of *D. maroccanus*.

[Popov (V. I.).] **Поповъ (В. И.). Stored Grain Pest Control in the City of Tsarevo during 1937.** [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **10** (1938) pp. 11–30, 6 figs. Sofia, 1939. (With a Summary in English.)

In Bulgaria, particularly in southern districts, heavy losses are regularly caused to stored grain by insects, the development of which is favoured by the warm climate and the defective state of the granaries, most of which are built of wood and are dark, damp and musty. Brief notes are given on the distribution and frequency of *Sitotroga cerealella*, Ol., *Calandra* (*Sitophilus*) *granaria*, L., *C.* (*S.*) *oryzae*, L., *Tenebroides mauritanicus*, L., and *Plodia interpunctella*, Hb., which are the most important. In the south and south-east, the predacious mite, *Pediculoides ventricosus*, Newp., which attacks the larvae of *S. cerealella* in fields, appears in the autumn in enormous numbers in granaries, where it feeds on the eggs, larvae and pupae of the various pests, but also causes outbreaks of severe dermatitis among the population [*cf. R.A.E.*, B **25** 153]. Horses fed on barley infested by the mite develop inflammation of the mouth. In the district of Harmanli, *P. ventricosus* causes a high mortality among silkworms [*Bombyx mori*, L.].

In August 1937, preliminary experiments were carried out in the town of Tzarevo, on the Black Sea, in which 118 tons of infested grain were fumigated with either Zyklon B [*cf.* A **24** 624] or carbon bisulphide. In the first test with Zyklon, sacks of wheat were placed in a portable wooden fumigation chamber with a capacity of 10 cu. m. [350 cu. ft.]; they were arranged in two rows of five layers on framework with a passage between them and a free space above, so that the chamber held over two tons of grain. The Zyklon was emptied on to the floor, in quantities giving 10, 20, 30, 50 and 100 gm. HCN per cu. m. [0·1, 0·2, 0·3, 0·5 and 1 oz. per 10 cu. ft.] and left for 24, 36 or 48 hours. The lowest rate that gave complete mortality of the pests was 30 gm., and exposure for 24 hours was sufficient. Similar results were obtained in a further test in which infested wheat was fumigated for 48 hours in a room of 33·28 cu. m., some of the grain being strewn on the floor in a layer 16 ins. deep and some placed in sacks along the walls. The room was made airtight by sticking strips of paper round the doors and window frames, and Zyklon containing 1,000 gm. HCN was emptied on newspapers placed on the

grain on the floor. Complete mortality was obtained of larvae and adults of *S. cerealella*, *T. mauritanicus* and *P. ventricosus*.

Treatment of infested wheat with carbon bisulphide was carried out in a specially constructed pit with a capacity of 12 cu. m. [about 420 cu. ft.]. About 3·25 tons of wheat were fumigated, the sacks being arranged in two rows of four layers and resting on frames. The carbon bisulphide was poured into shallow iron pans placed on the uppermost layer of sacks, the dosage used being 500 gm. per cu. m. [5 fl. oz. per 10 cu. ft.] with an exposure of 24 hours. The pit was covered with doors from old buildings with a 12-in. layer of wet shavings on the top. Complete mortality was obtained of all pests, including *C. granaria*, *T. mauritanicus*, *S. cerealella* and *P. ventricosus*. Equally good results were obtained with a dosage of 200 gm. per cu. m. and an exposure of 24 hours when the grain was treated in the fumigation chamber or in a pit of 10 cu. m. capacity lined with cement. The sacks were arranged on frames in two rows of eight layers each and the pit was covered in a way similar to that described above.

The cost of treatment was only one-third as great for carbon bisulphide as for Zyklon, and the former is therefore recommended for general use in Bulgaria, provided that proper precautions are taken against the risk of explosion.

[Chorbadzhiev (P.).] **Чорбаджиевъ (П.). Materialien über die schädlichen Insekten und anderen Feinde der Kulturpflanzen in Bulgarien.** [Data on injurious Insects and other Enemies of cultivated Plants in Bulgaria.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **10** (1938) pp. 55–72. Sofia, 1939. (With a Summary in German.)

Of the insect pests observed in Bulgaria in 1936–38 [*cf. R.A.E.*, A **25** 313], the most important were *Entomoscelis adonidis*, Pall., on rape, *Phytodecta fornicata*, Brüggm., on lucerne, *Thrips tabaci*, L., on tobacco, *Etiella zinckenella*, Treit., on soy beans, *Cydia* (*Laspeyresia*) *pomonella*, L., on apples and pears, *Hoplocampa minuta*, Christ (*fulvicornis*, F.) on plums, *Rhagoletis cerasi*, L., on cherries, *Calandra granaria*, L., in stored wheat, *Sitotroga cerealella*, Ol., chiefly in stored maize, and *Ephestia elutella*, Hb., in stored tobacco. Newly recorded or uncommon pests that were locally injurious included: *Pseudococcus citri*, Risso, which occurred on vines and caused the grapes to dry before they were ripe, *Aspidiotus hederae*, Vall., on ornamental plants, especially *Nerium oleander* and *Phoenix*, *Epidiaspis* (*Diaspis*) *leperii*, Sign., on fruit-trees, and *Bulgarialeurodes rosae*, Corbett, an outbreak of which occurred in 1934 on the foliage of roses in Sliven (eastern Bulgaria). Adults of the Telephorid, *Cantharis* (*Telephorus*) *obscura*, L., which were abundant near Plovdiv (central Bulgaria) attacked the young fruits of apricot and quince in April 1938 but were effectively controlled by sprays of Paris green at the rate of 0·8 and 1 lb. per 100 gals. water for apricot and quince, respectively, while those of *C.* (*T.*) *livida* var. *dispar*, F., injured about 80 per cent. of the fruits of cherry in Pleven (northern Bulgaria). Buprestids that caused injury in the adult stage were *Perotis lugubris*, F., which gnawed the buds and leaves of young plum trees, and *Agrilus derasofasciatus*, Lacord., which perforated the leaves of grape-vines. The ant, *Tetramorium caespitum*, L., killed about 60 per cent. of young plants of peppermint (*Mentha piperita*) near Novi-Pazar (eastern Bulgaria) in June 1937 by gnawing the epidermis of the roots and lower part of the stem.

[Popov (V. I.).] **Поповъ (В. И.). Greenhouse White "Fly"** *Asterochiton vaporariorum* **Westw. and its Control with Hydrocyanic-acid Gas.** [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **10** (1938) pp. 73–84, 1 fig., 11 refs. Sofia, 1939. (With a Summary in English.)

Notes are given on the biology, economic importance, food-plants and morphology of all stages of *Trialeurodes* (*Asterochiton*) *vaporariorum* Westw., which appeared in Bulgaria for the first time in large numbers in 1938 in greenhouses in Plovdiv and Kustendil and severely infested tomatos and cucumbers and, to a less extent, carnations and roses. The effect of fumigation with hydrocyanic acid gas released from a high grade of calcium cyanide powder (88 per cent. pure and containing 50 per cent. CN) was tested in several greenhouses. The powder was scattered two hours after sunset on the cement floor, on newspapers placed on the paths, or on laths placed on the heating pipes, and the relative humidity varied from 60 to 100 per cent. In Plovdiv, the greenhouse temperature was 16–18°C. [60·8–64·4°F.] at the beginning of the fumigation and 7–10°C. [44·6–50°F.] at the end. The period of fumigation was 8 hours, and the calcium cyanide was applied at rates of 0·3 and 0·2 oz. per 1,000 cu. ft. The percentage mortalities of adults, larvae and eggs were 100, 96 and 84, and 90, 88 and 80, respectively, but adults that must have emerged from pupae unaffected by the fumigation were present two days later. In Kustendil, the greenhouse temperature varied from 20–25°C. [68–77°F.] at the beginning of the fumigation to 16–18°C. at the end. Fumigation for 9 hours, using 0·1 oz. calcium cyanide per 1,000 cu. ft., killed all the adults in one greenhouse but only 60 per cent. in another, probably owing to the heavy rain that fell during the night ; the treatment was, therefore, repeated at twice the rate, and gave 100, 94 and 76 per cent. mortality of adults, larvae and eggs. No scorching was observed, except in the case of young tomatos in the greenhouse in which the cyanide had been used at the rate of 0·3 oz. They soon recovered, however, and fruited normally.

[Chorbadzhiev (P.).] **Чорбаджиевъ (П.). Verzeichnis der Schildläuse (Coccidae, Rhynchota) in Bulgarien.** [A List of Coccids found in Bulgaria.] [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **10** (1938) pp. 88–90. Sofia, 1939.

Records are given of the food-plants and local distribution in Bulgaria of 23 Coccids. Those that attack fruit trees are *Lecanium* (*Eulecanium*) *corni*, Bch., *L.* (*E.*) *coryli*, L., *L.* (*E.*) *persicae*, F., *L.* (*Sphaerolecanium*) *prunastri*, Boy., *Pulvinaria betulae*, L., *Aspidiotus ostreaeformis*, Curt., *Epidiaspis* (*Diaspis*) *leperii*, Sign., and *Lepidosaphes ulmi*, L. All of them are polyphagous, and *Lecanium corni* and *L. coryli* also cause considerable injury to roses grown for essential oil.

[Arkhangel'skiĭ (P. P.).] **Архангельский (П. П.). Injurious Bees (Apidae) of Uzbekistan.** [*In Russian.*]—*Social. Sci. Techn.* **6** no. 12 pp. 54–57, 1 ref. Tashkent, 1938. [Recd. 1939.]

Notes are given on the frequency of occurrence in Uzbekistan of leaf-cutting bees of the genus *Megachile* and on the damage they cause to the foliage of various trees. A survey carried out in 1936 in a number of orchards and gardens in the Provinces of Ferghana, Samarkand and Bokhara showed that roses, maple and cherries were

the most frequently attacked, but the heaviest injury was caused to pears. In May–June, *Ceratina cyanea*, Kirby, was found in a nursery in Tashkent tunnelling and building nests in the shoots of *Catalpa*.

[Stepantzev (I. N.).] **Степанцев (И. Н.). The meteorological Régime of the Cotton Aphids and their Distribution in Uzbekistan.** [*In Russian.*]—*Social. Sci. Techn.* **7** no. 2–3, pp. 83–94, 5 graphs, 1 map. Tashkent, 1939.

In Uzbekistan, cotton is attacked by several Aphids, of which *Aphis gossypii*, Glov., *A. laburni*, Kalt., and sometimes *Macrosiphum* (*Acyrthosiphon*) *gossypii*, Mordv., cause the most damage. *A. gossypii* has two peaks in seasonal occurrence, in May–June and August–September, while *A. laburni* is present in numbers only in the spring. Observations over several years have indicated that the fluctuations in the numbers and distribution of the Aphids depend on weather conditions. They are favoured by low temperature and high humidity. From a comparison of the data recorded by 20 meteorological stations in Uzbekistan for May and September during years in which outbreaks of *A. gossypii* occurred, the author concludes that the optimum conditions for its mass increase are a mean day and night temperature of about 20°C. [68°F.] and a relative humidity of about 60 per cent. Records show that the areas infested by this Aphid were most extensive in 1928, 1931, 1934 and 1937, and these years were characterised by favourable meteorological conditions in May and September.

Observations in 1934 showed that in all the districts in which *A. laburni* was abundant, the mean day and night temperature in May approached 18°C. [64·4°F.] and the relative humidity 63 per cent. In the case of *M. gossypii*, a severe outbreak of which occurred in certain Provinces in July–August 1936, the favourable combination was 23°C. [73·4°F.] and 58 per cent. relative humidity.

From these data and the local mean day and night temperature and humidity conditions, the author constructs a formula for each of the three Aphids, analogous to that evolved by him for the red spider on cotton [*cf. R.A.E.*, A **27** 147], by means of which it is possible to forecast their probable abundance and rapidity of development. He concludes that their distribution in Uzbekistan is regulated chiefly by the amount of precipitation for the five months from May till September, the optima being 26, 11, 5, 2 and 3 mm., respectively. The greater the deviation from these optima, the more the conditions become unfavourable for the Aphids. On the basis of these observations, he gives a formula for calculating an index showing the degree to which the meteorological conditions of the summer prevailing in a given district are favourable to *A. gossypii* and for estimating the percentage of the area under cotton that is likely to be infested.

Daguerre (J. B.). **Nuestros actuales conocimientos sobre la langosta. III. El equilibrio biológico.** [Our existing Knowledge on Locusts. III. The biological Balance.]—*Rev. Soc. ent. argent.* **10** no. 1 pp. 65–69. Buenos Aires, 1938. [Recd. 1939.]

The author considers that parasitism by Sarcophagids is the most important factor controlling locusts in Argentina. The gregarious locust, *Schistocerca paranensis*, Burm., is, however, protected from parasitism by its habit of migration [*cf. R.A.E.*, A **26** 147] and

living in swarms. The solitary locust, *S. cancellata*, Serv., is more exposed to attack, since it is sedentary and its population consists of individuals dispersed over wide areas, so that the chance of their being found by parasites is greater. This difference in the habits of the two locusts prevents *S. cancellata* from assuming outbreak proportions, in spite of the fact that it reproduces at a much greater rate since it has two generations a year. Thus, a biological equilibrium is maintained.

Pinto da Fonseca (J.). **A " broca " e o sombreamento dos cafezais.** [The Coffee Berry Borer and Shade in Coffee Plantations.]—*Biologico* **5** no. 7 pp. 133–136. São Paulo, 1939.

In view of the suggestion made in São Paulo that coffee should be grown under shade to provide natural conditions and thereby improve the quality of the crop, the author points out that shade may increase infestation by *Stephanoderes* [*hampei*, Ferr.]. During a visit to Uganda, he observed that infestation was least in plantations exposed to the sun and greatest in shaded situations ; in Brazil, it is greater in damp shaded plantations protected from the wind than in dry open areas. He considers that humidity, which is increased by shade, is favourable to the Scolytid and unfavourable to its parasites, *Prorops nasuta*, Wtstn., and *Heterospilus coffeicola*, Schmied. [*cf. R.A.E.*, A **24** 94], which do not control it completely in shade coffee in Uganda. It cannot be expected, therefore, that *P. nasuta* by itself will give control in shaded areas in Brazil. The author is satisfied, however, that the biological method is the best at present available.

Sabrosky (C. W.). **The European Frit Fly and its Forms in North America.**—*Ann. ent. Soc. Amer.* **32** no. 2 pp. 321–324, 5 refs. Columbus, Ohio, 1939.

From studies of a large quantity of material from various parts of North America, the author considers that the synonomy proposed by Aldrich for *Oscinella frit*, L. [*R.A.E.*, A **8** 183] is too broad. He gives a key distinguishing the adults of *O. frit*, *O. frit* var. *nitidissima*, Mg., *O. soror*, Macq., and *O. carbonaria*, Lw., with notes on their synonymy and distribution. All these forms occur in both Canada and the United States, but *O. frit* and its variety are especially prevalent in the north and west, and *O. soror* and *O. carbonaria* appear to have an eastern distribution. The form *pusilla*, Mg., often recorded from North America, is barely distinguishable from the typical *frit*, and is included with it by the author. He considers *O. variabilis*, Lw., a synonym of *O. soror*.

Beall (G.), Stirrett (G. M.) & Conners (I. L.). **A field Experiment on the Control of the European Corn Borer, *Pyrausta nubilalis* Hubn., by *Beauveria bassiana* Vuill. II.**—*Sci. Agric.* **19** no. 8 pp. 531–534, 2 refs. Ottawa, 1939.

A second field test of the effectiveness of *Beauveria bassiana* for the control of *Pyrausta nubilalis*, Hb., on maize was made in Ontario in 1937 [*cf. R.A.E.*, A **25** 630]. A culture of the fungus prepared in July 1936 and kept at room temperature served as the original source of inoculum. The method of preparing the latter and the field

technique are described. The test differed from that of 1936 in that all plots were dusted once only, on 9th, 15th or 20th July, and the spores were applied at two rates (10 and 40 gm. in 16 lb. wheat flour per acre). Some of the plants were coming into tassel on the second date and a few were in silk by the third. Oviposition had started before the first, and injury was noticeable on the last. Two examinations were made, between 30th August and 2nd September and early in November. At the first count, the application, on 9th, 15th and 20th July, of spores at 10 gm. per acre had effected 54, 60 and 67 per cent. control, and at 40 gm. per acre, 62, 66 and 71 per cent. The corresponding percentages at the second count were 41, 50, 56, 63, 64 and 62. Thus, an increase in the rate of application of the spores gave slight increase in control, but the effect of the time of application was much greater. It is probable that the most favourable time to apply the spores is after 20th July. In 1937, unlike 1936, control was effected rapidly, there being no improvement at the second count.

TURNER (N.). **Control of European Corn Borers on Dahlias.**—*Circ. Conn. agric. Exp. Sta.* no. 133, 3 pp., 1 fig. New Haven, Conn., 1939.

Pyrausta nubilalis, Hb., has become a serious pest of dahlias in Connecticut, where during August and September, second-generation larvae mine the branches and main stems, causing them to break and preventing the formation of flowers.

First-generation adults deposit eggs in masses on the surfaces of the lower leaves in August, and the larvae crawl up the plants and enter the terminal buds and small leaves, after which they tunnel downwards ; they may later leave the infested shoots and re-enter the plant elsewhere. If many larvae are present, the plant may be stunted. Infestation becomes apparent about the middle of August, when small necrotic areas appear on the buds and on the small leaves. Rapidly growing plants were the most heavily infested under field conditions, but all varieties were susceptible.

The overwintering population may be reduced by burning the infested stalks in late autumn or early spring, but despite this, infestation may be heavy in the succeeding year, since one generation is completed on other food-plants before dahlias are attacked. Removing infested buds and shoots is of value where infestation is slight. In tests carried out during 1936–37 [*R.A.E.*, A **26** 723], sufficient control to enable the plants to blossom normally was given by a dual-fixed nicotine dust (4 per cent. nicotine), a derris or cubé dust containing 1 per cent. rotenone, and a spray of 1 lb. powdered derris or cubé root (4 per cent. rotenone) in 25 U.S. gals. water with a suitable spreader. These insecticides should be applied to the tips of the growing shoots at intervals of 5–7 days between 5th August and mid-September. The spray is also effective against Aphids and thrips ; the rotenone dust has not proved effective against *P. nubilalis* on sweet maize [*cf.* **25** 770].

MACKIE (D. B.). **Entomological Service.**—*Bull. Dep. Agric. Calif.* **27** (1938) no. 6 pp. 645–668. Sacramento, Calif., 1939.

Notes are given on work in California in 1938 in connection with the campaign for the eradication of *Dialeurodes citri*, Ril. & How., and

Chrysomphalus obscurus, Comst. [*cf. R.A.E.*, A **26** 747]. The necessity for stricter supervision of the imported food-plants of the former was indicated by the fact that it was found on plants received from places east of the Mississipi and beyond the northern limit of its known distribution. *D. citrifolii*, Morg., was intercepted on mandarin oranges from Florida, and *D. chittendeni*, Laing, was found on an American laurel (*Kalmia latifolia*) that had originally come from Tennessee.

Twice during 1938, Californian fruit came under suspicion of being infested by *Cydia* (*Grapholitha*) *molesta*, Busck. In one case, a single pupa of *C. molesta* was found in New York in a shipment containing pears from California and peaches from South Carolina, and in the other, a shipment of 1,500 boxes of apples exported to French Morocco was rejected on arrival because larvae resembling those of this moth were observed in them. Inspection in the areas from which the pears and apples came failed to disclose the presence of *C. molesta*, and the larvae in the apples are believed to have been *Tortrix franciscana*, Wlsm., which was present in the orchard from which they originated, or *Enarmonia* (*G.*) *prunivora*, Walsh. *C. molesta* was intercepted in California on pears from Ohio and on apples from Connecticut. As the second generation of *C.* (*Carpocapsa*) *pomonella*, L., hatched at the time of the first picking of pears, newly hatched larvae, which were difficult to detect at the time of picking, were numerous in the fruit. Fumigation of the packed and wrapped fruit in the trucks ready for shipment with 2 lb. methyl bromide per 1,000 cu. ft. was found to destroy all larvae in 2–3 hours.

Parlatoria oleae, Colv., was found in December 1938 to be established on nearly 80 ornamental and economic plants, including all deciduous fruit trees. It is at present a pest of importance only on olives, of which it infests the leaves, branches and fruits ; its manner of sealing itself to the food-plant enables it to resist practically all contact sprays. Larvae of a species of *Rhagoletis* were found in fruits of the native bitter cherry, *Prunus emarginata*.

Damage to field crops and range plants was mainly due to grasshoppers, which were more numerous in 1938 than they had been during the preceding 10 years. Details are given of the dates of hatching and the local distribution of the principal species. Campaigns were carried out in spring and early summer to prevent the invasion of cultivated land, and surveys were made to locate populations and estimate the probable amount of egg laying in order to be able to forecast the prospects for 1939. The field cricket, *Gryllulus* (*Gryllus*) *assimilis*, F., did less damage than in 1937. When residential areas were invaded by it in the late summer, large numbers of the Reduviid, *Rasahus thoracicus*, Stål, which is predacious on it, were attracted, and cases of their biting man were recorded. Of the pests of lucerne, *Colias* (*Eurymus*) *eurytheme*, Boisd., caused considerable damage, particularly in the warmer counties, but *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.) spread only slightly.

Pests of deciduous fruits in the Sacramento Valley included *Taeniothrips inconsequens*, Uzel, which caused considerable loss of pears, and *Hyphantria cunea*, Dru., which damaged walnuts, particularly in areas in which willows were prevalent. It is reported that *Paratetranychus ilicis*, McGregor, is rapidly becoming distributed in southern California, and is adapting itself to walnuts. *P. pilosus*, C. & F., caused considerable local loss of pears and prunes, though the

population was generally less than in 1937. *Anarsia lineatella*, Zell., caused much damage to some varieties of almonds. *Lepidosaphes ficus*, Sign., on figs and *Pseudococcus maritimus*, Ehrh., on grapevines were controlled by fumigation with hydrocyanic acid gas. The grape leaf-hopper, *Erythroneura comes*, Say, caused some damage in central California. *Pseudococcus gahani*, Green, which had been under almost complete control on *Citrus* since the introduction of the Aphelinid, *Coccophagus gurneyi*, Comp., in 1931 [**20** 22], was slightly more numerous in 1938. In investigations on Eriophyid mites [**26** 650 ; **27** 33, 288], 49 species have been found, of which 39 were new. Notes are given on some of the species taken on economic plants.

The area dusted or sprayed by aeroplane was somewhat reduced in 1938, greater consideration was given to air conditions at the time of application, and fewer complaints of drifting dust were received. [*cf.* **26** 748]. Lists (showing the areas concerned in each case) are given of the crops treated, the materials used and the pests and diseases against which the work was directed.

McKenzie (H. L.). **A Revision of the Genus** *Chrysomphalus* **and supplementary Notes on the Genus** *Aonidiella* **(Homoptera ; Coccoidea ; Diaspididae).**—*Microentomology* **4** pt. 2 pp. 51–77, 10 figs. Stanford Univ., Calif., 1939.

The author discusses the status and scope of the genus *Chrysomphalus* and gives a list of the species that have at any time been referred to it either as a genus or a subgenus, another of the 8 species that he considers to be so referable and of their synonyms, and a key to these species. Their food-plants, distribution and characters are given and, in a supplement, similar information is appended for *C. nulliporus*, sp. n., which is described from an orchid (*Dendrobium leonis*) in the Philippine Islands. The 9 species are figured. The perivulvar pores are present in all except *C. nulliporus*. The geographical distribution of the genus is discussed by G. F. Ferris. In a supplement to a paper already noticed [*R.A.E.*, A **26** 469], a new species of *Aonidiella* is described, and additions are made to the synonymy of *A. orientalis*, Newst.

Hastings (E. B.) & Pepper (J. H.). **Studies on some of the Factors involved in the Use of Sodium Arsenite against the Mormon Cricket (***Anabrus simplex* **Hald.).**—*Bull. Mont. agric. Exp. Sta.* no. 370, 26 pp., 13 figs., 8 refs. Bozeman, Mont., 1939.

Work in Montana has shown that a dust of 1 part sodium arsenite and 3 parts of a suitable diluent is effective against the Mormon cricket, *Anabrus simplex*, Hald., when distributed at the rate of 8 lb. per acre. Diatomaceous earth has of recent years largely replaced hydrated lime as the diluent, since it causes less discomfort to the operators. The effectiveness of the treatment depends upon an even distribution of a dust of uniform quality, and investigations were therefore carried out on the chemical composition of the arsenical used, the physical properties of the dusts and their possible effects on the insect. The sodium arsenite used in the cricket campaigns contained an average of 82 per cent. arsenic trioxide (As_2O_3) and was

therefore considered to be a solid solution, the composition of which depended on the percentages of the ingredients used in its production. When diatomaceous earth, Celite (a commercially processed diatomaceous earth), hydrated lime, calcium carbonate, bentonite and volcanic ash were tested as diluents, mixing 3 parts diluent with 1 part sodium arsenite did not interfere with the determination of the amount of As_2O_3 in the mixture. Sodium arsenite and diatomaceous earth could be thoroughly mixed in these proportions in a ball mill or an eccentric type of field mixer in 10 minutes. When sets of tubes containing sodium arsenite mixed with diatomaceous earth and volcanic ash (the lightest and heaviest of the diluents) were subjected to jarring for one hour, to simulate the effects of transport, there was only a slight change in concentration in samples taken from the bottom of the tubes. The dust tended to form small pellets on the surface, and the concentration of arsenite was slightly increased. The columns of dust were very elastic, and the greatest changes in concentration would therefore be expected at the top and bottom.

The authors describe a dust nozzle that was used in laboratory tests on the possible carrying properties of the various diluents. The nozzle was held at a height of 2 ft., and the dust was allowed to settle in Petri dishes placed at 1-ft. intervals for a distance of 14 ft. The proportion of arsenite to diluent was not constant over the whole distance, and the two ingredients appeared to settle independently of each other. The inert substance, therefore, acts only as a diluent, and the extent of the dust cloud is not a measure of the distribution of the poison. The greatest uniformity of distribution was given by diluents consisting of comparatively large particles, such as volcanic ash and bentonite. With finely divided diluents, such as diatomaceous earth, a lethal dust could be obtained only as far as the undiluted arsenite could be blown, that is, about 11 ft. The amounts of arsenite deposited at distances of 1–3 and 12–14 ft. from the nozzle were in the approximate ratio of 100 : 1, but it is suggested that the effect of this would be somewhat offset in the field by the overlapping of dust clouds.

Factors affecting the permeability of the cell membranes of insects are briefly discussed ; young tissues are in general more permeable than older ones. To determine the toxicity of a dust of 1 part meta sodium arsenite and 3 parts hydrated lime when entering the body in various ways, adult crickets were dusted and kept at 36°C. [96·8°F.] and 50 per cent. relative humidity. After 12 hours, the percentage mortalities averaged 95 for individuals that were prevented (by collars) from cleaning themselves after they were dusted, 97 for those that were allowed to clean themselves (and therefore to ingest the dust) and 58 for those of which the tarsi had been dipped in the dust. The last figure rose to 87 after 20 hours. The crickets did not all begin cleaning their tarsi immediately when these only had been dusted, and it is therefore doubtful whether poisoned dust barriers are effective in the field unless they are placed in furrows, in which case large portions of the bodies of the insects become covered with dust. In other experiments, the crickets began to clean their bodies immediately at temperatures above 20°C. [68°F.], irrespective of the humidity, and they were killed more quickly when the humidity was high. They did very little cleaning at lower temperatures. The time required for a 50 per cent. kill was greater for the adults than for the immature stages, and it increased with the decreasing temperature more rapidly in the

case of the former than in that of the latter. Since the time required to obtain 50 per cent. mortality varied very little for the different diluents, it is assumed that they are all inert. In experiments to find the time for which sodium arsenite dusts must remain on the body to give this mortality, 300 adults were dusted with a mixture of diatomaceous earth and meta sodium arsenite (3 : 1) and kept in groups of 100 at temperatures of 20, 25 and 30°C. [68, 77 and 86°F.]. Crickets from each cabinet were washed at various intervals and placed in rearing cans. The results were somewhat erratic, but indicated that there was no mortality among those washed immediately after being dusted, and little among those washed 30 minutes later. The total time required to give 50 per cent. mortality decreased as the dust was allowed to remain longer on the crickets.

HALLOCK (H. C.). **Notes on Pennsylvania Flea Beetles in Tobacco Fields (Coleoptera : Chrysomelidae).**—*Ent. News* **50** nos. 5–6 pp. 121–124, 156–159, 5 refs. Philadelphia, Pa, 1939.

The author discusses the relative abundance of 11 species of flea-beetles found in south-eastern Pennsylvania on tobacco and 20 other plants growing in or near the tobacco fields in 1937 and 1938. The most numerous on tobacco were *Epitrix parvula*, F., and *E. cucumeris*, Harr. Adults of *E. parvula* were seen in the field from 20th April to 10th November, but the species did not cause extensive injury to the leaves until after 10th July in 1937 and mid-August in 1938. There was a heavy migration of *Systena taeniata* var. *blanda*, Melsh., from wild food-plants to newly transplanted tobacco about the middle of June 1937, but it was scarce in 1938. During May and June 1938, *E. cucumeris* was the most abundant species on tobacco. Early feeding caused heavy loss. *E. parvula* was collected on 19 of the other plants examined, and *E. cucumeris* on 14. *E. cucumeris* and *E. parvula* were the only species abundant on potato, the former throughout the season and the latter from July onwards. *E. fuscula*, Crotch, was abundant on egg-plant [*Solanum melongena*], but only a few individuals were found in the potato fields [*cf. R.A.E.*, A **19** 200]. Flea-beetle feeding was conspicuous on tomato plants in seed beds and on recently transplanted tomatos during May and June 1938. In late May, *E. cucumeris* and *E. parvula* were in the proportion of 22 : 3. *E. parvula*, *E. cucumeris* and *Chaetocnema pulicaria*, Melsh., were moderately plentiful on maize from May until September, and fed on the leaves and silks, but did not injure the crop. The young silk was particularly attractive to *E. parvula*. Ground cherry (*Physalis* sp.) in the vicinity of the tobacco fields was constantly injured by *E. cucumeris* and *E. parvula*, and Jimson weed (*Datura stramonium*) by *E. parvula*. During September 1937, *E. parvula* occurred in considerable numbers on morning glory (*Convolvulus sepium*), but in 1938, over 95 per cent. of the flea-beetles found on this plant were *C. confinis*, Crotch. After the old tobacco stumps had been destroyed in 1938, large numbers of *E. parvula* were found on Indian mallow (*Abutilon theophrasti*). When the remains of the tobacco crop were ploughed in, the flea-beetles congregated on weeds and also on any portions of the tobacco plants remaining uncovered. These were soon destroyed by their feeding, and, in September and October, the population rapidly decreased. When the fields were disked in October instead of being ploughed earlier, a heavy population continued during October.

Felt (E. P.). **A new Juniper Midge (Diptera : Cecidomyiidae).**—*Ent. News* **50** no. 6 pp. 159–160. Philadelphia, Pa, 1939.

Descriptions are given of both sexes of *Contarinia juniperina*, sp. n., which caused serious injury to twigs of juniper over a considerable area in the middle west of the United States in 1938.

Knowlton (G. F.) & Allen (M. W.). **Aphids of the Genus *Kakimia* infesting *Ribes* (Homoptera).**—*Ent. News* **50** no. 6 pp. 166–170, 2 figs. Philadelphia, Pa, 1939.

A key is given to seven species of Aphids that attack *Ribes* in the United States and belong to the subgenus *Kakimia* of *Myzus*, which the authors considers a distinct genus. They include a new species, *M.* (*K.*) *muesebecki*, sp. n., which is described from alate and apterous viviparae taken on *Ribes* sp. in California in 1916. A reference to the original description and the food-plants and place or places of collection are given for each of the other species, together with taxonomic and descriptive notes in most cases.

Hewitt (W. B.), Jacob (H. E.), Proebsting (E. L.) & Lamiman (J. F.). **Red Leaf Disease of Grapes in California cured by controlling Mites.**—*Phytopathology* **29** no. 1 p. 10. Lancaster, Pa., 1939.

A destructive type of red leaf disease of vines occurs in many vineyards in California. It usually appears by mid-summer as a red coloration of the leaf tissue between the primary veins, and causes partial or complete defoliation by late summer, followed by a weak development of new terminal leaves. The grapes often fail to mature or shrivel. Heavy fertilisation failed to prevent the affection, but it was checked by a spray containing potassium ammonium selenosulphide (Selocide) and wettable sulphur applied in July 1937 to 114 vines for the control of *Tetranychus pacificus*, McG., and by this spray and one of ammonium polysulphide in 1938. It was not checked by applying selenious acid to pruning wounds.

Yu (T. F.). **Mild-mosaic Virus of Broad Bean.**—*Phytopathology* **29** no. 5 pp. 448–455, 1 fig., 25 refs. Lancaster, Pa., 1939.

In April 1934, plants of broad bean (*Vicia faba*) in Chekiang were observed to be affected by a mild mosaic disease, the symptoms of which are described. Investigations on transmission of the virus included tests with several Aphids. *Aphis rumicis*, L., transmitted it from diseased plants to 30–60 per cent. of healthy seedlings, the incubation period varying from 12 to 25 days. An air temperature above 25°C. [77°F.] seemed unfavourable for the development of the symptoms. The adult Aphids became infective after feeding for 10 minutes on diseased plants, but in order to infect a high percentage of healthy plants it was found necessary to allow them to feed for at least an hour. *A. rumicis* also transmitted the virus from broad bean to lucerne, red clover (*Trifolium pratense*), white clover (*T. repens*), white sweet clover (*Melilotus alba*), vetches (*Vicia* spp.), sweet pea (*Lathyrus odoratus*) and field pea, but not to tobacco, tomato, cucumber, beans of the genus *Phaseolus*, *Dolichos lablab*, soy bean, or cowpea (*Vigna sinensis*).

The virus was also transmitted, though less readily, by *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), but not by *Myzus persicae*, Sulz., or *Macrosiphum solanifolii*, Ashm. (*gei*, auct.).

Miao (C. F.). **Study on Some Forest Insects of Nanking and its Vicinity Part II. Observations on Lappet Moth (*Metanastria ampla* Walker).** —*Contr. biol. Lab. Sci. Soc. China* (zool.). **13** no. 2 pp. 9–22, 1 fig., 37 refs. Shanghai, 1939.

Field and laboratory studies were carried out at Nanking on the bionomics of *Metanastria ampla*, Wlk., which attacks various forest trees, a list of which is given, in the lower Yangtsze Valley and is an important pest of oaks. All stages, including the 7 larval instars, are described. This Lasiocampid has one generation a year. The eggs are laid in late autumn singly on the twigs of the food-plant or elsewhere, and usually hatch in the second half of March or early April. In the insectary at a temperature of 15·5°C. [59·9°F.], hatching occurred in late February. The maximum, minimum and average durations of the larval instars are shown in a table ; larval development was more rapid in the field than in the insectary. The period of heavy feeding lasts about 170 days; large numbers of young oaks in all districts near Nanking have been almost completely defoliated for several years in succession and are seriously weakened. If the weather is hot and sunny, the larvae often move to cool shaded positions near the ground and remain there during the heat of the day. They pupate in early autumn (some as early as August in 1934), in cocoons constructed in sheltered places, and the adults emerge during late October and November. Both sexes are inactive by day, especially when the weather is wet. The females lay about 400 eggs in the course of about a week.

Takahashi (R.). **Some Aleyrodidae, Aphididae, and Coccidae from Micronesia (Homoptera).**—*Tenthredo* **2** no. 3 pp. 234–272, 11 figs., 3 refs. Shinomiya, Yamashina, Kyoto, 1939.

Records are given of 5 species of Aleurodids, 4 species of Aphids and 51 species and 2 varieties of Coccids from Japanese Mandated Micronesia, with notes on the characters of some of them. One of the Aleurodids and several of the Coccids are described as new. The new Coccids include *Pseudococcus oceanicus* from coconut in the Caroline Islands.

Busck (A.). **Restriction of the Genus *Gelechia* (Lepidoptera : Gelechiidae), with Descriptions of new Genera.**—*Proc. U.S. nat. Mus.* **86** no. 3064 pp. 563–593, 14 pls. Washington, 1939.

The genus *Gelechia* has commonly been used to contain hundreds of heterogeneous species that could not readily be assigned to other genera on wing or palpal characters. From a study of the genitalia, the author finds it possible to divide these species under a number of genera, some of which have been considered synonymous with it while others are described as new. In making this classification, he also deals with species of the genus *Gnorimoschema* (with which he considers *Phthorimaea* congeneric) since these species are more closely allied to *Gelechia* than those in many of the other genera that he separates from it. The seven new genera erected include *Keiferia*, *Filatima* and

Fascista. Keys are given to the genera, based on the genitalia of both sexes, and lists of American and European species included in them. The generic assignments of species mentioned in this *Review* (the first eight in *Phthorimaea* and the others in *Gelechia*) include *Keiferia altisolani*, Keifer, *K. elmorei*, Keifer, *K. glochinella*, Zell., *K. lycopersicella*, Busck, *Gnorimoschema gudmannella*, Wlsm., *G. plaesiosema*, Turner (*melanoplintha*, Meyr., *tuberosella*, Busck), *G. operculella*, Zell., *G. striatella*, Murtf., *Filatima persicaeella*, Murtf. (*confusella*, Chambers), *F. demissae*, Keifer, *F. neotrophella*, Heinr., *F. pseudacaciella*, Chambers, *F. saliciphaga*, Keifer, *Fascista cercerisella*, Chambers, *Chionodes hibiscella*, Busck, *C. negundella*, Heinr., *C. trichostola*, Meyr., *Bryotropha terrella*, Schiff. (Hb.) and *Aroga trialbamaculella*, Chambers. *Gnorimoschema artemisiella*, Kearfott, is considered a synonym of *G. axenopis*, Meyr., and *Chionodes* (*Gelechia*) *langei*, Keifer, of *C. retiniella*, Barnes & Busck.

[Sakharov (N. L.).] **Сахаров (Н. Л.). The Meadow Moth.** [*In Russian.*]—*Social. Grain Fmg* 1938 no. 6 pp. 160–169, 1 fig., 1 ref. Saratov, 1939.

Records are given of the years in which outbreaks of *Loxostege sticticalis*, L., have occurred in the south-east of European Russia, and data on its biology and control are reviewed in some detail. There is no evidence of periodicity in the sequence of outbreaks. The migrating larvae can be kept out of fields of susceptible crops if these are surrounded by a strip, 16–33 ft. wide, of varieties of bush beans of which the stems, leaves and pods are covered with sharp hook-like hairs. Tepary beans (*Phaseolus acutifolius* var. *latifolius*) are especially suitable, as they are more hairy than other varieties. The larvae, which readily attack the beans, become entangled in the hairs and die. A small bean plant having 3–5 leaves may thus trap as many as 50 larvae.

[Grivanov (K. P.).] **Гриванов (К. П.). Deep Ploughing instead of Burning the Stubble for the Control of the Wheat Thrips** (*Haplothrips tritici* **Kurd.)** [*In Russian.*]—*Social. Grain Fmg* 1938 no. 6 pp. 182–188, 1 graph, 8 refs. Saratov, 1939.

Outbreaks of *Haplothrips tritici*, Kurdj., which is widely distributed on wheat in the Russian Union, frequently occur in the south-east of European Russia [*cf. R.A.E.*, A **27** 554]. Experiments on the control of the larvae hibernating in the soil by cultivating fields that had been under wheat in 1937 were carried out in the spring of 1938 in a district situated east of the Volga. The effectiveness of different methods of cultivation was determined by comparing the numbers of adults that emerged from the plots from 20th May onward, the thrips being caught in bottomless wooden boxes placed on the soil and having a glass test-tube inserted at one side. The results are given in a table showing the numbers taken and the percentages of thrips emerging from untreated stubble that these represent. The best results (6·5 per cent. emergence) were obtained in a plot in which the soil was scarified and then ploughed to a depth of about 9 ins. in autumn and harrowed twice in the spring. Deep ploughing exposes the thrips to unfavourable conditions of temperature and humidity, owing to which they die before emergence or are attacked by fungi ; a number of larvae and pupae attacked by a

species of *Entomophthora* were found in spring in wheat stubble that had been ploughed in.

Russian agricultural experts now consider that the common method of burning cereal stubble to destroy insect pests is detrimental to the soil, as it causes the formation of potash and soda, which reduce the compactness of the soil, and results in the release of the bound nitrogen. The author points out that this would be especially harmful in the arid south-eastern parts of European Russia. Moreover, the method would be ineffective against *H. tritici*, as observations in 1938 showed that only a very few larvae remain in the stubble after harvest, the vast majority making their way into the soil to depths of 4–4½ ins., probably because of the prevailing heat and drought. Periodical examinations of soil samples showed that the thrips did not begin to return towards the soil surface until October and November. The dependence of their vertical migrations on the humidity and temperature of the soil was shown in special observations from 30th July to 2nd August in plots of wheat stubble. Larvae were abundant on the surface of the soil and in the upper layer in a low-lying irrigated plot in which the soil was damp and cool, but congregated in the deeper layers in soil that was hot and dry.

[Sakharov (N. L.).] **Сахаров (Н. Л.). Wireworms, Tenebrionids and their Control.** [*In Russian.*]—*Social. Grain Fmg* 1939 no. 1 pp. 142–157, 9 refs. Saratov, 1939.

In the south-east of European Russia, the areas of prevalence of Elaterids and Tenebrionids are divided by a line joining the towns of Uralsk and Saratov. Elaterids become increasingly abundant to the north and north-west of this line, and Tenebrionids, which thrive under dry conditions, to the south and south-east. Lists are given of 43 species of Elaterids and 23 species of Tenebrionids observed by the author in the Lower Volga region (Provinces of Stalingrad and Saratov) over a number of years, with notes on the distribution and abundance of some of them and the plants they attacked, and general accounts of the bionomics of the two families.

The commonest Elaterids, in order of decreasing abundance, were *Agriotes sputator*, L., which was by far the most numerous, *Corymbites* (*Selatosomus*) *latus*, F., and *A. gurgistanus*, Fald. The adults of the first two are present in May and those of *A. gurgistanus* in August. The larvae of the latter are most numerous in short-term fallow and in fields under root crops, whereas those of *A. sputator* are abundant in land covered with couch grass [*Agropyrum repens*], and those of *C. latus* prefer virgin soil overgrown with species of *Festuca* and *Stipa*. The damage caused by wireworms to the seeds of cereals in the soil, the stems of sprouting plants and the roots of beet and other root crops is briefly discussed. The survival of the larvae is favoured by the presence or absence of couch grass [*cf. R.A.E.*, A **23** 615] and by humidity of the soil [*cf.* **18** 48]. Examination of samples of soil showed that the numbers of larvae increased in direct proportion to the number of roots of couch grass per linear metre. They were also abundant in fallow land overgrown with *Bromus* spp., but when crops were cultivated annually in such land their numbers fell sharply after 2–3 years and were then reduced by 75 per cent. each year.

The author considers that fumigating the soil against wireworms [*cf.* **27** 683] would be too expensive and that control should consist in the application of agricultural measures, such as early and dense sowing of cereals in the spring, and the destruction of couch grass and *Bromus* in fallow land by thorough cultivation and deep autumn ploughing. In small plots to be used for valuable crops, good results were obtained by broadcasting poisoned maize seed at the rate of 45 lb. per acre and harrowing it into the soil. The seed was poisoned by boiling it in water for at least two hours with sodium arsenite at the rate of 3 oz. to 10 lb. maize.

The most injurious Tenebrionids were *Tentyria nomas*, Pall., *Dasus* (*Gonocephalum*) *pusillus*, F., *Opatrum sabulosum*, L., and *Blaps halophila*, Fisch. In the Lower Volga region, oviposition is very protracted and occurs chiefly in loose, sandy soil well exposed to the sun and thinly covered with vegetation, such as fields of sunflowers, beet, maize or cucurbits. The larvae of *B. halophila*, which require 15 months for development, injure the seeds of autumn- and spring-sown cereals and the roots of summer wheat, and those of *O. sabulosum* and *D. pusillus*, which complete development in two months, attack the root collars and young stems of cucurbits. Injury is also caused by the adults of these three species to chick-peas [*Cicer arietinum*] and soy beans, but chiefly to sunflowers, of which they destroy the cotyledons and damage the leaves and stems. The larvae of *T. nomas*, which hibernate, attack soy beans, chick-peas, sunflowers and cucurbits.

Control measures should include irrigation of the fields to kill the eggs, thorough cultivation of the soil and deep autumn ploughing to destroy the weeds that serve as alternative food-plants for the larvae, and killing the adults with baits of bran or oil cake poisoned with sodium arsenite or Paris green. The bait should be covered with heaps of grass or straw, under which the beetles congregate during the day.

[Moiseev (A. E.).] **Моисеев (А. Е.). Control of the May-beetle in protective Strips of Forest Trees.** [*In Russian.*]—*Social. Grain Fmg* 1939 no. 3 pp. 132–136, 11 figs., 3 refs. Saratov, 1939.

In the south-east of European Russia, considerable damage is caused to trees in protective strips planted along the edges of cultivated fields by adults of *Melolontha hippocastani*, F. The beetles emerge from the soil at the end of April or beginning of May, the males 4–5 days before the females. Oak, birch, maple, chestnut, willows, ash and poplar are the preferred food-plants. The beetles feed mostly on leaves on the upper and middle parts of the crown ; they are particularly voracious between 10 a.m. and 2 p.m. and least so between 2 and 6 a.m. They can fly for over a mile in search of suitable trees. The females emerge with immature ovaries, and feeding is essential for their development. Dissection of females in 1938 showed that at first the number of mature eggs increased slowly, but that later there was a sharp rise in the curve, which had two peaks, about 10th and 23rd May. The beetles oviposit at the time of the first peak and then resume feeding, so that further eggs are matured. Under experimental conditions, 2 of 7 females oviposited twice ; the two periods of egg maturation lasted 10–18 and 11–13 days, respectively. As the beetles feed before oviposition and oviposit more than once, the author considers that dusting against them would be an effective auxiliary control measure. Dusting from an aeroplane would not be practicable in

forests, but would be suitable for treating protective strips of trees, as they are planted in a straight line and could be covered in a single flight. It should be carried out immediately after the emergence of the adults and repeated if necessary during the second period of feeding.

WILSON (G. F.). **Amaryllis Pests.**—*J. R. hort. Soc.* **64** pt. 7 pp. 318–326, 5 pls., 12 refs. London, 1939.

An investigation was made in south-eastern England to ascertain the identity of the pests that cause the reddish spots and streaks on the bulb, leaves and flower-stem of amaryllis (*Hippeastrum*), and the species of mite primarily responsible for the reddening of the leaves as they emerge from the bulb, and to devise measures for the prevention of such injury. The principal pests of amaryllis in England are *Merodon equestris*, F., *Rhizoglyphus echinopus*, Fum. & R., *Tarsonemus laticeps*, Halbert, *Tetranychus telarius*, L., thrips and *Pseudococcus maritimus*, Ehrh. ; the last four are those chiefly responsible for the red staining of the leaves due to the formation of anthocyanin pigment, while *R. echinopus* frequently produces red spots on the outer scales of the bulb. The control of *Tetranychus*, thrips and *Pseudococcus*, which feed on the leaves, presents no great difficulty, but that of *R. echinopus*, which hides beneath the outer bulb scales, and *Tarsonemus laticeps*, which congregates and feeds between the scales in the region of the neck of the bulb and between the inner scale leaves, required investigation.

The major part of the paper is devoted to a discussion of the systematic position, bionomics and control of *T. laticeps*, with which Ewing has found *T. approximatus*, Banks, var. *narcissi*, Ewing [*cf. R.A.E.*, A **17** 310 ; **22** 489, etc.] and *T. hydrocephalus*, Vitzth. [**21** 668] to be synonymous. The various stages are very briefly described. Infestation is first indicated by the appearance of reddish spots on the leaves. The reddening is intensified on the upper part of both sides of the bulb scales and may extend downwards into the bulbs for some distance. The reddish lesions elongate as the leaves grow and may attain several inches in length. In an experiment in February 1939, adults of this mite, transferred from infested *Narcissus* bulbs to healthy amaryllis bulbs, fed on the latter causing the reddish streaks to appear. Breeding began about a week after the mites had been transferred, and an active colony soon developed. The mite population increases rapidly when the bulbs are brought from the storage-room into a heated glasshouse and decreases during the summer, as the mites are not well adapted to dry conditions. Young plants were less infested than bulbs 3–5 years old, and amaryllis bulbs were never seen to be so infested that the mites were forced to move about on the exposed leaf surfaces as they have been found to do on *Narcissus* [**22** 490].

For control, in addition to treatment of the bulbs themselves, the material in which bulbs have been plunged should be removed and discarded or subjected to steam sterilisation, the floor of the plunging bed and the surrounding walls and staging should be thoroughly wetted with boiling water, and pots and crocks should be immersed in boiling water for several minutes. To test the value of treating the bulbs with hot water [*cf.* **21** 668], 10 infested bulbs, 3 or 4 years old, were placed in a dry store towards the end of September 1938, and on 1st November, when they were completely dormant, 8 were immersed

for 20, 30, 60 or 90 minutes in water at a constant temperature of 110°F., allowed to cool naturally or immersed for 5 minutes in cold water, dried thoroughly, potted in 5-inch pots in sterilised soil and placed in a glasshouse with a mean temperature of 60°F. Bulbs that were immersed in hot water and cooled naturally produced more vigorous growth than the controls and flowered considerably sooner. Rapid cooling of bulbs immersed for 30, 60, or 90 minutes retarded growth considerably. A quantity of seed was produced by the flowers on the treated bulbs. Injury to the leaves occurred only where the bulbs had been cooled rapidly, and it was permanent in the case of the bulb that had been subjected to rapid cooling after 90 minutes' exposure. It is desirable to keep the humidity of the air and soil as low as is consistent with successful forcing, so that the drier conditions may affect any mites that may have escaped previous treatment. Hastening the initial stages of growth will help to reduce injury at the most critical time.

THALENHORST (W.). **Zur Ausbreitung und Bekämpfung der Douglasienwollaus.** [On the Spread and Control of *Chermes cooleyi*.]—*Dtsch. Forstwirt* **21** no. 68 pp. 844–845. Berlin, 1939.

Notes are given on the distribution in Germany of *Chermes* (*Gillettëlla*) *cooleyi*, Gill., on Douglas fir [*Pseudotsuga taxifolia*], based on replies to a questionnaire issued in view of a recent paper [*R.A.E.*, A **28** 41]. It was present in many districts, and though the injury caused has in most cases been slight, it is considered that infestation will continue to spread if weather conditions are favourable, and that outbreaks may occur in areas in which Coccinellids and Syrphids are not numerous. In a brief discussion of control measures, it is stated that the removal of heavily infested trees is not warranted in every case, especially as nicotine sprays have been found effective on trees up to about 12 ft. in height. It is generally impracticable to spray taller trees in closed stands, and spraying is only economically justified when it is desired to check especially serious foci of infestation.

PUSSARD (R.). **Un ravageur de la lavande,** *Sophronia humerella* **Schiff. (Lép. Gelechiidae).**—*C. R. Socs sav.* **71** (1938) pp. 273–281, 17 refs. Paris, 1939.

An account is given of the bionomics of *Sophronia humerella*, Schiff., which, during the last 10 years, has caused serious reductions in the yield of lavender (*Lavandula vera*) in the Basses-Alpes [*cf. R.A.E.*, A **25** 485; **26** 301]. All stages of this Tineid are described, and its distribution is given from the literature. At an altitude of about 3,000 ft., adults are present from about 20th June until early August. During the hot hours of the day and the cool of the early morning, they rest on the old wood of the lavender bushes or on the dead leaves at their base. Activity begins at sunset and is greatest at dusk. In breeding cages, the moths were positively phototropic when disturbed, and they were attracted to light-traps at night. They were also attracted to fermenting sweetened beer.

In nature, eggs are deposited from 1st July to mid-August singly or in groups of up to 7 in rough places on the old wood, and hatch in about a fortnight at 23°C. [73·4°F.]. On hatching, the larvae construct minute white cocoons in cracks or scars near the point where they

hatched. As many as 7 larvae were found in one cocoon. This probably represents the total number hatching from one batch of eggs. Occasionally more were found, but in such cases, two cocoons were usually found to be stuck together. The larvae remain in diapause in the cocoons from August to March. They then emerge and move to the upper surface or more rarely the edge of the closely rolled outer leaves of the bud, where, having severed the hairs that cover the upper epidermis, they penetrate the parenchyma and mine the leaves for about a month. Unsuccessful attempts at penetration are often made. These are revealed by patches of the size of an entrance hole, free from hairs. The hairs are rejected by the larvae, which partly explains the ineffectiveness of arsenicals against them [*cf.* **25** 485]. The larvae are not morphologically adapted to mining, and this phase of the life-history was previously unknown. There may be several mined leaves in one bud, two larvae sometimes occur in a single mine, and a larva may mine several leaves. In the second half of April, the larvae leave their mines and go to the upper surfaces of the leaves, but they soon penetrate the centre of the buds, of which they web up the leaves. If the bushes are beaten about this time over a white cloth, many larvae that have not yet entered the buds can be collected. Within the bud, the larvae feed on the meristem, and the early-developing individuals completely destroy the flowering tip. Injury is at its height during the second half of May, and larval development is completed in some individuals by early June. Pupation takes place within the web.

From a review of the literature, it is concluded that *S. humerella* lives principally on Compositae and Labiatae and secondarily on Umbelliferae and Ranunculaceae. In the Basses-Alpes, it was not found on any plant other than *Lavandula vera*, but larvae of all ages fed readily on *Artemisia vulgaris* in the laboratory. No eggs were laid on *A. vulgaris* in pots among lavender in a heavily infested plantation in 1937. Larvae taken from lavender buds on emergence from diapause and placed on *A. vulgaris* did not make mines, but settled at the edges of the leaves and fed on the parenchyma and lower epidermis and sometimes the upper epidermis also. They were then covered above and below by layers of hairs bound with webbing.

Pussard (R.). **Contribution à l'étude des Embioptera. Note préliminaire sur** *Embia* (*Monotylota*) *ramburi* **Rimsky.**—*C. R. Socs sav.* **71** (1938) pp. 283–289, 7 refs. Paris, 1939.

In 1937, plants of violet (*Viola odorata*) in the Department of Var were killed by the feeding of Embioptera on the roots. Brief notes are given on the systematic position of this order and on the appearance and distribution of insects belonging to it. More than 150 larvae were taken from 6–7 violet plants received for examination in October, and many of the lower leaves of the plants were dried and perforated. The larvae were mostly situated in silken galleries either in the earth or in dried leaves or around the petioles or rhizome ; some were in cavities in the rhizomes. Rearing was begun on 3rd November, and, at 25°C. [77°F.], apterous adults were obtained in the middle of January 1938. From the males, they were identified as *Embia ramburi*, R.-K. The larvae fed readily on flaked oats, potato, cassava, pine kernels and carrot. Larvae isolated on leaves of violet on the plant

perforated them to some extent, and fragments of epidermal cells, chlorophyll grains and remains of hairs were found in the excreta. The diet of *Embia* spp. is discussed from the literature. They are often phytophagous. Attacks on cultivated plants by Embioptera have been recorded three times only, always on orchids [*R.A.E.*, A **13** 301]. In 1934, *E. vayssierei*, Navás, was recorded from stored ground-nuts and cereals in Senegal [**22** 593]. The attack of the Embiids on the violet roots facilitated the penetration of secondary infestations, notably of Nematodes. The infested violets were grown in irrigated beds, protected from the sun by heather screens, and the conditions were thus very favourable for Embiids, which seek heat, damp and darkness. The infestation was extremely localised, on a plot where the soil was less deep and more stony and clayey than that of the surrounding plots.

Larvae kept with or without food in a dry atmosphere lived for 15–20 days at 25°C. Those kept without food at a temperature between 2 and 15°C. [35·6–59°F.] lived for 3½ months if the atmosphere was dry and for 5 months if it was moist. With a moist atmosphere and a temperature below 10°C. [50°F.] and with potato supplied as food, larvae remained in diapause, in a kind of cocoon formed by a short gallery with thick, silken walls and more or less closed at both ends, for about 3½ months. After two weeks during which the temperature was between 10 and 13°C. [55·4°F.], they resumed activity and fed. The first eggs laid by the adults that emerged in mid-January from larvae kept from 3rd November at 25°C. and high humidity and fed on potato were found on 18th January in the galleries, and larvae hatched about a fortnight later. In November also, about 40 larvae were placed on a plant of *Viola* sp., in a pot filled with mould. On 18th March, there were a few larvae in diapause among the dried leaves, and, against the sides of the pot, loose silken galleries in the mould, and many of the original larvae and a few young ones among the roots and rootlets at a depth of about 6 ins. It is concluded that the conditions, and particularly the food, were very favourable. In addition to being necessary for the development of *E. ramburi*, a fairly high humidity appears to favour the secretion of silk, as the thickness of the walls of the galleries increases with the humidity. The function of the galleries is discussed, and their detrimental influence on the effectiveness of liquid insecticides is pointed out. They cannot be wetted with pure water and a wetting agent must be used.

PUSSARD (R.). **Contribution à l'étude de la nutrition des Psyllides. Présence d'une amylase dans les glandes salivaires de quelques Psyllides adultes.**—*C. R. Socs sav.* **71** (1938) pp. 291–292, 4 refs. Paris, 1939.

The author has previously reported experiments in which he showed that the feeding of Psyllids produces stylet sheaths in the tissues of the food-plant [*R.A.E.*, A **21** 172], as that of Aphids was shown to do by Davidson [**11** 250]. He now reports that the salivary glands of adults of three species of *Psylla* feeding on pear in France, *P. pyri*, L., *P. pyricola*, Först., and *P. pyrisuga*, Först., contain a diastase, identical with that found by Davidson in Aphids, which converts starch into soluble carbohydrates. The technique by which this was demonstrated is described.

Memoria de los trabajos realizados por la Estación de Fitopatologia agrícola de La Coruña, años 1937-1938. [The Work of the phytopathological Station of Corunna, 1937–1938.]—*Publ. Estac. Fitopat. agríc. Galicia* no. 13, 40 pp., text ill. Corunna, 1939.

This report includes information on various insects attacking cultivated plants in Galicia in 1937 and 1938, and also a list (pp. 11–16) of pests additional to those recorded in previous ones [*cf. R.A.E.*, A **24** 83, 84]. Laboratory studies on a species of *Aphidius* parasitising *Brevicoryne brassicae*, L., on cabbage showed that adults survived for 6–7 days without food. When fed on 4 per cent. sugar solution they lived for 15–20 days, and on the 9th day were still able to parasitise the Aphid. The adults of the third generation bred in captivity showed loss of vitality and parasitised very few Aphids. The distribution of *Aphelinus mali*, Hald., against *Eriosoma lanigerum*, Hsm., on apple was continued in 1937 and 1938. *Aspidiotiphagus citrinus*, Crwf., was bred from *Chionaspis euonymi*, Comst., on *Euonymus* and *Aulacaspis rosae*, Bch., on rose. Grape vines in the Ribadavia district were attacked by *Pseudococcus citri*, Risso, a few adults of which were also observed on fig. The abundant moisture on the stems and leaves and on the ground beneath the vines, which favoured the growth of sooty mould [*cf.* **26** 757], was found to be due, not simply to honey-dew secreted by the Coccids, but also to exudation from the vines, which was possibly a result of the irritation caused by infestation.

An outbreak of *Tettigonia viridissima*, L., accompanied in smaller numbers by *Decticus verrucivorus*, L., occurred in Bimeda in 1938, owing probably to the prolonged drought. *Locusta migratoria*, L., was present in small numbers. The control measures applied included a poison bait consisting of 100 lb. bran, 5 lb. sodium arsenate, 10 lb. molasses and 2–5 gals. water, distributed at the rate of about 90 lb. per acre, preferably in strips round plots and also across large ones. Many dead locusts were observed 3–4 days after the treatment. Unusually severe injury was caused to potato and also to tobacco by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell.

Briejèr (C. J.). **Methallyl Chloride as a Fumigant against Insects infesting Stored Products.**—Med. 8vo, xv+101 pp., 3 figs., 6 pls., 3 graphs (1 fldg.), 39 refs. Amsterdam, N.V. de Bataafsche Petrol. Maatsch. Lab., 1939.

An account is given of a great variety of experiments carried out in Holland on the use as a fumigant against pests of stored products of methallyl chloride, a colourless, inflammable and strongly smelling liquid [prepared from petroleum hydrocarbons] that evaporates readily, giving a gas that is three times as heavy as air. The insects tested in the laboratory were chiefly *Calandra granaria*, L., and *C. oryzae*, L. The technique by which they were bred and their bionomics are briefly described, and other fumigants that have been used against them are reviewed.

In the experiments, the weevils were not all killed immediately by fumigation; some died from its effects after a few days. Methallyl chloride acted also as an irritant [*cf. R.A.E.*, A **27** 111], and even a low concentration induced considerable activity. Experiments at temperatures of 17–19°C. [62·6–66·2°F.] in which the fumigation period was 24 hours indicated that the dosages that gave complete mortality of adults of *C. granaria* and *C. oryzae* within about a week

were 18·75 and 12·5 gm. per cu. m. [18¾ and 12½ oz. per 1,000 cu. ft.]. Eggs, larvae and pupae of both species in wheat were all killed by a dosage of 17·5 gm. and all stages by one of 18·5 gm. Further experiments showed that the penetrative capacity of the gas was sufficient to kill weevils in bags of wheat, and it is considered that, provided that a gas penetrates quickly enough to reach the middle of the bags within the period of fumigation, its actual penetrative capacity is not of such importance as is generally thought, since if it penetrates slowly, it also escapes slowly during the process of airing. Pumping would, however, be necessary to obtain sufficient concentrations in silos.

Flour prepared from wheat that had been fumigated at 18°C. [64·4°F.] for 24 hours with a dose of 72·5 gm. per cu. m. had a slightly musty smell that persisted in the bread baked from it, and the taste of the bread was also affected. There was a margin between the minimum effective dosage and the maximum dosage that could be applied without affecting the quality of the wheat, and this margin was increased when the fumigation time was reduced, since the dosage needed was only four times as great when the latter was reduced to one-eighth (3 hours). The influence on the germinating power of seeds varied, but was slight in most cases unless the seeds were very damp. Bulbs and tubers were undamaged by the gas, but the growing parts of plants were in some cases injured.

Fumigation for 24 hours with an approximate dosage of 70 gm. per cu. m. at 20°C. [68°F.] killed all stages of *C. granaria* and *C. oryzae* in wheat and maize, *Sitodrepa panicea*, L., and *Ephestia elutella*, Hb., in cacao beans, *Endrosis lacteëlla*, Schiff., in peas, *Aphomia* (*Paralipsa*) *gularis*, Zell., in apricot stones and currants, *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., in potatoes, and *Dermestes lardarius*, L., in cowhair. All the products were in bags, except the currants, which were in cases, and none was affected adversely, with the exception of the wheat and the apricot stones, both of which acquired a slightly musty smell. Detailed accounts are given of successful fumigations carried out in a cacao storage loft and a cacao factory, both infested by *Ephestia elutella*; an old warehouse containing nuts, sugar, dried fruits, flour, a prepared cereal food and ginger, infested by *A. gularis*; and a vacuum installation in which maize infested by *C. granaria*, *C. oryzae* and *Tribolium* spp. was fumigated. Unprepared fox skins infested by *D. lardarius* and bales of tobacco fumigated in large fumigating boxes in the laboratory were undamaged. From the results, it is concluded that products that are unaffected by the gas are best fumigated for 24 hours at an actual gas concentration of about 20 gm. per cu. m. or for 40 hours or more at a concentration of about 12–15 gm. A dosage of 30–40 gm. will generally be adequate in specially constructed fumigation chambers and vacuum installations, but products that absorb the gas and buildings with much woodwork or that cannot be completely closed off require a higher dosage (about 70–90 gm.). Where there is great risk of loss, the gas is best applied by slow evaporation from flat trays placed as high as possible and containing liquid to a depth of 1 cm. Where a fumigation time of 8 hours is desirable to avoid deleterious effects on odour or taste and the fumigation space is thoroughly air-tight, a dosage of about 65 gm. is adequate, and the gas is best applied by atomisation.

In a chapter in which further laboratory experiments are described, the author states that the gram-hour value of a fumigant (the figure

obtained by multiplying the number of grams applied per cu. m. by the time required for the fumigation to be effective) is of use as an index of its practical value when it is determined under conditions that approximate to those occurring in practice, but not when it is determined under ideal laboratory conditions, where no allowance is made for loss of gas by absorption, leakage, etc. Under favourable fumigation conditions, the gram-hour value approximates to the c.t. value obtained by Haber's formula [**23** 121] in which gas concentration obtained instead of dosage applied is related to time. For methallyl chloride, the approximate c.t. value and the corresponding gram-hour value, both determined under laboratory conditions, were 160 and about 200, respectively ; the gram-hour values determined in fumigating boxes and in practical fumigations were 324–600 and 500–1,000.

Haber's law applies to methallyl chloride for fumigation times of 1–4 hours. The gram-hour value increases as the fumigation time increases and the dosage decreases, and the gas is therefore more effective at high concentrations and with short fumigation times. The values for fumigation periods of 24, 6 and 3 hours were related in the proportion 2·15 : 1·17 : 1, and for 6 hours the approximate gram-hour value for practical fumigation of average commodities was 480. The values for intermediate fumigation periods, based on this rate, and also for higher and lower rates (50 and 100 gm. instead of 80 per cu. m. for a fumigation period of 6 hours), from which the dosage to be applied in practice can be calculated, are shown on a graph.

A list is given of the minimum dosages affording complete mortality of a number of insect pests within a week of fumigation for 24 hours at 20°C. ; they vary from 11·6 to 21 gm. per cu. m. Instructions are appended for the practical application of the fumigant.

Smit (B.). **The Control of Household Insects in South Africa.**—*Bull. Dep. Agric. S. Afr.* no. 192, 52 pp., 20 figs., 14 refs. Pretoria, 1938. Price 6*d*. [Recd. 1939.]

Notes are given on the bionomics and control of various insects that may be pests in houses in South Africa, including ants, clothes moths, book lice (Psocids), silver fish (*Ctenolepisma*), *Dermestes vulpinus*, F. [*cf. R.A.E.*, A **22** 617], termites and Lyctids that damage woodwork, and the usual pests of stored grain.

Mendes (L. O. T.). **Relação de insetos encontrados sôbre plantas do Estado de São Paulo nos anos de 1936–1937.** [Report on Insects found on Plants in the State of S. Paulo in 1936–37.]—*Bol. téc. Inst. agron. Estado S. Paulo* no. 53, 10 pp., 1 ref. Campinas, 1939.

A list, arranged according to food-plants, is given of insects taken on economic plants in São Paulo in 1936 and 1937. Those observed on cotton are not included, as an annotated list of them has already been published [*R.A.E.*, A **27** 34].

Gomez Menor (J.). **Nueva contribución al estudio de los insectos que dañan el roble.** [A further Note on Insects attacking Catalpa.]—*Rev. Agric. Repub. Dominicana* **30** no. 117 pp. 295–296, 3 figs. San Cristóbal, 1939.

A list is given of insect pests that damage catalpa trees [*Catalpa longisiliqua*] in the Dominican Republic. In addition to those already

noticed [*R.A.E.*, A **24** 259], it includes the Cassidid, *Batonota aurita*, Boh., which feeds on the leaves, and the Coccid, *Pulvinaria urbicola*, Ckll., which infests the branches but is controlled by natural enemies, including the Agromyzid, *Leucopis bella*, Lw.

FIFE (L. C.). **Insects and a Mite found on Cotton in Puerto Rico, with Notes on their Economic Importance and Natural Enemies.**—*Bull. P. R. Exp. Sta. Mayaguez* no. 39, 14 pp., 45 refs. Washington, D.C., 1939.

A list is given of 84 species of insects and one mite taken on cotton in Porto Rico and their parasites and predators, comprising those found by the author during 1935–37 and those reported by other workers. Notes are given on their economic importance and natural control.

The following is taken from the author's summary: *Platyedra* (*Pectinophora*) *gossypiella*, Saund., is the most serious pest and probably destroys 30–50 per cent. of the crop annually. Several species of leaf feeders are found, the most common being *Alabama argillacea*, Hb., which may cause severe loss, especially in areas of light rainfall. Four armyworms, *Laphygma frugiperda*, S. & A., *L. sunia*, Gn., *Prodenia pulchella*, H.-S., and *P. dolichos*, F., are present, but they seldom if ever become sufficiently numerous to be of economic importance. *Heliothis armigera*, Hb. (*obsoleta*, F.) is a serious pest of maize, but does not often attack cotton. Severe injury is caused by plant bugs, of which Pyrrhocorids (*Dysdercus andreae*, L., and *D. sanguinarius*, Stål) and Pentatomids are the most important, but damage is also caused by Capsids, Lygaeids and Coreids. Boll-feeding Heteroptera injured, on an average, about 20 per cent. of the bolls. Several species of Coccids are found, but they never become sufficiently numerous to attain economic status. They apparently become abundant on cotton only when the plant is a perennial. *Aphis gossypii*, Glov., is widely distributed, but is effectively checked by heavy rain, numerous predators and parasites and causes little damage. Several species of Jassids puncture the stem and leaves and extract large quantities of sap, but the plants do not appear to be seriously affected. *Scapteriscus vicinus*, Scudder, and *Feltia subterranea*, F., occasionally injure young seedling cotton seriously. The mite, *Eriophyes gossypii*, Banks, may entirely prevent the development of fruit if attack begins on the young growing plants. *P. gossypiella*, the Heteroptera, *E. gossypii* and *Alabama argillacea* are the major pests. Although none of the other species individually has caused extensive damage, the total injury has been considerable.

GLICK (P. A.). **The Distribution of Insects, Spiders and Mites in the Air.**—*Tech. Bull. U.S. Dep. Agric.* no. 673, 150 pp., 5 pls., 2 figs., 11 graphs, 79 refs. Washington, D.C., 1939.

Some of the information contained in this account of investigations on the aerial distribution of insects, mites and spiders carried out in north-eastern Louisiana during 1926–31 and in northern Mexico in 1928 has already been noticed [*R.A.E.*, A **19** 633]. Several types of aeroplane, including one specially constructed for the purpose, were employed during the investigation. Insect traps with two insect proof compartments [*loc. cit.*] were used in the earlier flights, but were later replaced by types with a single compartment in which both exposed

and unexposed screens were stored. In a description of the method of manipulation of the traps, it is stated that insects cannot be carried up by suction during the ascent of the aeroplane, since air is then forced downwards behind it, but it is probable that some were swept away from the traps by air currents set up by the resistance of the screen.

In Louisiana, collections were made over forest and swamp land with some cultivated areas, at 23 altitudes varying from 20 to 16,000 ft., in all months of the year and at all times of the day ; all records were based on the catch of one screen exposed for 10 minutes at a known speed. In all, 28,739 specimens were collected, comprising spiders, mites and 17 orders of insects ; they included 4 genera and 23 species of insects new to science.

Tables and graphs show the total numbers of individuals of each order collected at each altitude by day during the whole period, and during each month in the daytime ; the average density of the population at altitudes of up to 5,000 ft. ; the numbers of individuals of each order with the numbers of families, genera and species represented in each ; the total number of individuals of each species caught at each altitude by day and by night ; and the average numbers of individuals of certain orders caught in 10 minutes flying time by day and night in various months and also at altitudes of up to 5,000 ft.

Diptera were the most abundant insects, and were nearly three times as numerous in the traps as those of any other Order. By day, more insects were collected in 10 minutes during May, November and September than in any other month, and fewer in January and December ; by night, most were taken in October and May. A summary of the results obtained for each order contains notes on the species of economic importance. The relation of the size and weight of insects to the height to which they may be carried is discussed ; besides those already noticed [*loc. cit.*], insects taken at great heights include Coccinellids, Chrysomelids, Carabids and Staphylinids (5,000–11,000 ft.), small Hymenoptera, larvae, nymphs and apterous adult insects (up to 14,000 ft.) and mites. Living insects were taken in numbers at altitudes up to 5,000 ft., and single living insects up to 9,000 ft. ; the evidence indicated that many taken in the upper air were alive at the time of trapping. Experimental evidence, some of which has already been noticed [**24** 412], indicating that insects can live under the conditions prevailing in the upper air and can reproduce normally after being carried to new localities, is quoted. Since the velocity of prevailing winds is greater at heights of 3,000 ft. and over, the migration and dispersal of insects reaching such altitudes alive is greatly facilitated.

The effect of meteorological factors on aerial distribution is discussed under the headings of temperature, dew-point, relative and absolute humidity, vapour and barometric pressure, air currents (including wind velocity, wind direction, and convection), light intensity, cloud conditions, rainfall and the electrical state of the atmosphere.

A section deals with the effect of the floods of the Mississippi river during 1927 on the insect population of the air. At low altitudes, fewer insects than usual occurred, but normal numbers were recorded at 1,000–5,000 ft., where insects had flown or drifted in from unflooded areas.

In Mexico, flights were made at daybreak, in the morning and afternoon and at sunset during August–September 1928 over cultivated and desert land at altitudes up to 4,000 ft. Insects belonging to 9

orders were collected ; the total number of individuals of each species and the numbers collected at each altitude is shown in a table. The variation in the numbers of insects collected at different altitudes at different times of day is discussed with reference to convection currents, and the abundance at different altitudes over different types of vegetation with reference to the prevailing winds.

During the investigations, living insects were frequently observed in the cabin or cockpit of the aeroplanes. The author points out the danger of the dispersal of insect pests by this means, and the advantages of collecting from aeroplanes over land and sea in determining sources of infestation and the routes of migratory insects. Other work on aerial distribution carried out in the United States [**22** 393] and elsewhere [**23** 338 ; **27** 167] is summarised.

Gibson (A.) & Twinn (C. R.). **Household Insects and their Control (with a Chapter on Animal Pests other than Insects).**—*Publ. Dep. Agric. Canada* no. 642 (Ent. Bull. no. 30) 100 pp., 102 figs., many refs. Ottawa, 1939. Price 25 *cts.*

This publication, which is a revision of one already noticed [*R.A.E.*, A **18** 22] and contains a still larger number of original illustrations, is very comprehensive and includes information on the bionomics and control not only of insects that damage foodstuffs, clothing, carpets, upholstered furniture, tobacco, books and wood in Canada, but also of those that are pests of ornamental plants used indoors, those that may be brought into the house on vegetables and fruit and those that may occasionally enter houses and be a nuisance. One section is concerned with the fumigants and other insecticides recommended for the control of various pests and the way in which they should be applied, and another with methods of controlling pests by superheating or freezing.

Farrer (M. D.). **How to stop Weevil Damage in Stored Grain.**—*Circ. Ill. agric. Exp. Sta.* no. 489, 8 pp., 3 figs. Urbana, Ill., 1939.

A popular account is given of control by fumigation and other methods of insects attacking grain stored on farms in Illinois. Of the available fumigants, carbon bisulphide is considered to be the best. Other control measures include the thorough incorporation of fine pyrethrum dusts (0·5 per cent. pyrethrin content) with the grain at the rate of 1 lb. in 8 bushels. These dusts give excellent protection against insects, and the treated grain can be safely used as food for animals. Maize in the ear can be protected without affecting the germinating power of the seed by dipping the ears into an 8 per cent. sulphonated white oil emulsion. Soy beans and cowpeas stored in bins for seed can be protected by covering them immediately after threshing with a layer of hydrated lime to a depth of about $\frac{1}{2}$ in., or hydrated lime can be mixed with small quantities at the rate of 1 : 4 parts by weight. Seed stocks of maize or small grains that have been treated with fungicides containing mercury are comparatively safe from insect attack.

Donohoe (H. C.). **Notes on Coleoptera found in Raisin Storages.**—*Proc. ent. Soc. Wash.* **41** no. 5 pp. 154–162, 1 ref. Washington, D.C., 1939.

An annotated list is given of 32 species of Coleoptera belonging to 26 genera and 13 families, which, in addition to numerous unidentified

species, have been found in sheds in California in which raisins are stored. They have either been found repeatedly or are closely related to the genera or species that have often been found. Of them, 11 are known to be pests of raisins or other dried fruits, 6, including 3 of the above, are cosmopolitan species attacking stored grain or cereal products, 3 are scavengers and 3 infest fermenting fruits. The remainder occur because of favourable places for hibernation or for unknown reasons.

Muesebeck (C. F. W.). **A new reared *Meteorus* from Tasmania (Hymenoptera : Braconidae).**—*Proc. ent. Soc. Wash.* **41** no. 5 pp. 172–173. Washington, D.C., 1939.

Meteorus dumbletoni, sp. n., is described from two females and three males reared from *Tortrix postvittana*, Wlk., on apple in Tasmania in February 1937.

Latta (R.). **Vapor-heat Treatment for the Control of Narcissus Bulb Pests in the Pacific Northwest.**—*Tech. Bull. U.S. Dep. Agric.* no. 672, 53 pp., 34 figs., 8 refs. Washington, D.C., 1939.

The following is based on the author's summary of this detailed account of investigations in Washington State, the preliminary results of which have already been noticed [*R.A.E.*, A **20** 689], on the control of pests of narcissus bulbs by treating the bulbs with vapour heat : The most favourable results were given by treatment at a temperature of 110–111°F. Complete mortality was obtained after exposure for 1½ hours in the case of the Syrphids, *Merodon equestris*, F., and *Eumerus* spp., and for 30 minutes in the case of the mites, *Tarsonemus laticeps*, Halbert (*approximatus* var. *narcissi*, Ewing) and *Rhizoglyphus hyacinthi*, Banks. The bulb nematode was almost competely controlled by treatment for 8 hours at the same temperature. Bulbs intended for greenhouse-flower production should be dried for at least 3 weeks and treated in the first half of August for not more than 2 hours at 110–111°F. for the control of insects and mites. Varietal differences in tolerance to vapour-heat treatment were observed, certain varieties responding favourably only to treatment early in the season.

Bulbs intended for field planting for bulb production can receive treatments of long duration ; the effect on flowers is not associated with the effect on bulb increase. When properly applied, the treatment results in vigorous growth and increased bulb production. The bulbs may be treated with satisfactory results throughout an extensive period, but studies on nematode control indicated that they should be treated soon after lifting. Treatment for 8 hours is recommended as a protective measure for planting stock.

Bulbs can be treated in consecutive seasons without detrimental effects ; treatment with a Ceresan dip (2 per cent. ethyl mercury chloride) to control basal rot is compatible with vapour-heat treatment.

Baker (E. W.). **The Fig Mite, *Eriophyes ficus* Cotte, and other Mites of the Fig Tree, *Ficus carica* Linn.**—*Bull. Dep. Agric. Calif.* **28** no. 4 pp. 266–275, 9 figs., 11 refs. Sacramento, Calif., 1939.

The author describes all stages and discusses the nomenclature of the fig mite, *Eriophyes ficus*, Cotte, of which he considers *E. fici*, Essig, to be a synonym [*cf. R.A.E.*, A **27** 34], and gives an account

of investigations on its bionomics on fig, mostly the Adriatic variety, carried out in California in 1936–38, with notes on other Arthropods associated with it. *E. ficus* was described from France [**9** 360] and occurs throughout California and in Oregon and Florida. The laboratory technique adopted in rearing it is described, and the means by which it is distributed in nature are discussed [**16** 443]. The spores of the smuts and moulds that infect figs are not carried by *E. ficus*, but by the predators, *Seiulus* (*Seius*) *pomi*, Parrott, and *Leptothrips mali*, Fitch, which attack it [**20** 357, 358; **22** 29]. Its feeding, however, possibly causes necrotic areas on the figs, which are readily attacked by fungi.

The eggs are laid throughout the year in the buds or fruits or on the leaves or branches, and cemented to the plant tissue. The egg stage, the active larval and nymphal stages, and the quiescent larval and nymphal moulting stages each lasted about 5 days in summer. The mites suck the plant juices and live on the bud scales, leaves or fig gall surfaces. They usually scar the eye scales of the fig, and this damage occurs in almost all figs that are full-grown but still green. A sufficiently heavy infestation will damage the bud scales and possibly the immature leaves in the bud, the seeds, and occasionally, towards the end of the summer, the lower surfaces of mature leaves. The thrips, *Frankliniella occidentalis*, Perg., causes a similar injury inside the figs. In winter, about 10 per cent. of the terminal buds are infested and contain from ten to several hundred mites of all stages, although the predacious mite, *S. pomi*, frequently reduces the population considerably. In early spring, the mites remain on both surfaces of the leaves when they grow out of the buds, but when the leaves begin to mature, they occur mostly on the lower surfaces. The population is small in spring and reaches its maximum in June or July, when almost all the leaves are infested, some by more than 5,000 mites. Infestation of first-crop figs begins within two weeks of their formation. During this period (March–April) in 1938 the percentage infestation was 4. It reaches a peak in June (90 per cent. infestation in 1937), but when the figs are fully grown with the eye scales loosening, *S. pomi* enters them and considerably reduces the numbers of *E. ficus*. The unfertilised Calimyrna first-crop figs drop from the tree before the mite becomes numerous, and in them the percentage infested and the numbers of mites present are low. During the infestation of first-crop figs, the percentage infestation of the buds is almost unchanged, though the mite population increases slightly. In July, infestation of the leaves is reduced to a minimum, owing to migration and mortality due to predacious mites.

Second-crop figs are free from mites for about eight days after they begin to develop, after which the percentage infestation and the actual numbers of mites per fig gradually increase. Nearly all are infested by the beginning of July, when all stages of the mite are present in the figs. As the eye scales loosen, *S. pomi* enters the figs, and the numbers of *E. ficus* are reduced until none is present in Adriatic figs when normal drying is completed, or in other varieties when they are ripe. There is some movement of mites from the figs, but the numbers on the terminal buds do not increase as those in the figs decrease, and it seems probable that few reach the buds, most of them being killed by *S. pomi* or by the syrup exuded by the ripening figs. A certain amount of movement from bud to bud may occur throughout the year. The percentage infestation of the buds varied from 0 to

50 during the summer. *E. ficus* is found throughout the year in the three crops of caprifigs, as well as in the buds and on the leaves.

S. pomi can destroy large numbers of *E. ficus* in a short time, but it is unable to attack it in the buds, unless it can get under the scales. It overwinters in terminal buds with loosened scales and in lichens on trunks and branches. Throughout all but the coldest season, it preys on small mites or insects. It lays eggs during the winter, but, probably owing to the cold and lack of food, there is little increase in the population. In spring, it oviposits on both surfaces of the leaves, and its numbers increase, though more slowly than those of *E. ficus*, so that the population reaches its peak after *E. ficus* has left the leaves. Later it moves to the ripening figs, where it increases more rapidly. *Pronematus ubiquitus*, McG., is less numerous and less effective than *S. pomi*, but kills considerable numbers of *E. ficus*. It usually lives on the lower surface of the leaves in summer, but was also observed round the eye or among the eye scales of the fig. In winter it occurred in the buds. Other mites, believed to prey on *E. ficus* and other small Arthropods are *Cheletomimus ornatus*, Berl., and *Cheyletia* sp. Dipterous larvae, possibly those of the Cecidomyiid, *Arthrocnodax occidentalis*, Felt, were observed preying on the fig mites on the lower leaf surfaces, and in colonies of other Eriophyids. The Anthocorid, *Orius* (*Triphleps*) *tristicolor*, White, was predacious on *S. pomi*.

Rhyncaphytoptus ficifoliae, Keifer [*cf.* **27** 288] is the only Eriophyid other than *E. ficus* found on fig trees in California. It occurs on the lower leaf surfaces of some varieties in the San Joaquin valley and Lower Sacramento valley. There are usually only a few hundred individuals to a leaf, and a general movement to the figs does not appear to take place, but one individual was found in a fig in 1938, suggesting some degree of migration. *Tetranychus pacificus*, McG., was numerous on one variety of fig in late summer and also attacked other varieties.

TUCKER (R. P.). **The relative Solubility of the Lead Arsenates and Calcium Arsenates.**—*Bull. Dep. Agric. Calif.* **28** no. 4 pp. 276–283, 7 refs. Sacramento, Calif., 1939.

The following is substantially the author's summary : The possible effect is discussed of carbon dioxide in concentrations such as the atmosphere provides, of soluble chlorides, of hydrolysis and of components present as very soluble impurities upon the solubility of the arsenic pentoxide component of the lead and calcium arsenates. From the results of a laboratory study of basic lead arsenate, dilead arsenate and basic calcium arsenate, it appears that basic lead arsenate would, in field practice, be very resistant to the effect of hydrolysis, to carbon dioxide and to soluble chlorides so far as the solubility of the arsenic pentoxide component is concerned ; that dilead arsenate would not be seriously affected by hydrolysis or by carbon dioxide, but that it would be very susceptible to the action of soluble chlorides ; and that basic calcium arsenate would not be seriously affected by hydrolysis or by soluble chlorides, but that it would be susceptible to the action of the carbon dioxide present in the atmosphere.

It is emphasised that the arsenic pentoxide component, if present in small amounts as a very soluble impurity in the commercial materials, may have a decided bearing upon the toxicity to foliage of basic lead arsenate, dilead arsenate and basic calcium arsenate. It

would appear, therefore, that manufacturers of these arsenicals should exercise the greatest care possible that soluble impurities containing the arsenic pentoxide component be kept down to the minimum that industrial practice will allow.

LANGE (W. H.). **A hitherto unreported Noctuid Stem Borer of Corn and Globe Artichoke in California (Lepidoptera Noctuidae** *Emboloecia sauzalitae* **Grt.).**—*Bull. Dep. Agric. Calif.* **28** no. 4 pp. 288–290, 4 figs., 1 ref. Sacramento, Calif., 1939.

During 1936–38, larvae of the Noctuid, *Emboloecia sauzalitae*, Grote, were found on a number of different plants on the Californian coast just south of San Francisco, including artichoke (*Cynara*) and sweet maize. The larvae bore in the stem of the food-plant, and often, as they grow larger, penetrate into the root system. There is usually an opening near the top of the boring, through which frass is pushed. Thistles (*Cirsium*) are the usual food-plants, and maize and artichokes are infested either because they are planted near infested thistles, or because of the progressive eradication of the native food-plants.

The egg is unknown, but is believed to overwinter on dried plants or on small living thistles. The other stages are briefly described. There is one generation a year, the larvae appearing between April and July and pupating between June and September. The adults emerge between July and November, with a peak in September. During May 1938, larvae were found to be parasitised by an undetermined species of *Microbracon*. Each larva bore several parasite cocoons. *E. sauzalitae* is of little economic importance at present, but may become more injurious as the destruction of its native food-plants is continued.

KASTON (B. J.). **The Native Elm Bark Beetle** *Hylurgopinus rufipes* **(Eichhoff) in Connecticut.**—*Bull. Conn. agric. Exp. Sta.* no. 420, 39 pp., 19 figs., 33 refs. New Haven, Conn., 1939.

In view of its apparent importance in the dissemination of the fungus [*Ophiostoma ulmi*] causing Dutch elm disease, investigations were made in Connecticut on the bionomics of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh. This Scolytid occurs throughout the State, and is much more abundant than *Scolytus multistriatus*, Marsh, while of four areas in the United States in which the disease is present but from which *S. multistriatus* is absent, one occurs in Connecticut.

There are usually $1\frac{1}{2}$ generations a year. The progeny of individuals that overwinter as larvae complete development during the summer and hibernate as adults, which in their turn give rise to a generation of which the progeny hibernate as larvae. There may also in some cases be two generations a year, or more rarely, only one. The entrance, egg and larval galleries and their construction are described [*cf. R.A.E.*, A **24** 180; **27** 69]. The female oviposits in elm branches and trunks that are dying or dead but not dry. Most of the entries into trap logs occurred in May or June, into those that had not lost more than half their water content. The upper surfaces were seldom entered unless they were in deep shade. The entrance tunnels may be made by either

sex. The first egg is laid about a week after the entrance tunnel is begun, and oviposition is continued as the gallery is extended. As many as 6 eggs are laid in a day, but the average in late June and early July is probably 3–4. Females laid only one set of eggs in a season.

The larva hatches in 5–6 days at a temperature of 25°C. [77°F.], and feeds in a line approximately at right angles to that of the egg gallery and usually parallel to the grain. Laboratory experiments showed that neither the larvae nor the adults digested the cellulose in the wood. The larval stage lasted 29 days in the laboratory at 24·5°C. [76·1°F.] and 40–50 days in the field in summer. Work on the number of larval instars is recapitulated [**25** 426], and their durations are given. After the formation of the pupal cell, usually in the inner bark, but occasionally, when the log is dry, in the outer bark, there is a prepupal stage lasting almost two days. The average duration of the pupal stage decreased from 57·7 days at 10°C. [50°F.] to 5·42 days at 30°C. [86°F.]. It is believed to last 8–9 days in July under field conditions.

When the adult has emerged from the pupa and hardened, it bores its way to the surface. If the outer bark is loosened from the inner, it may cut through the inner bark and then groove the surfaces between the two bark layers until it can emerge through a crack or the broken end of the log. When a log was enclosed with about 275 beetles at a temperature of 24·5°C., the emergence of young adults from it began 57 days later, reached a maximum after 17–18 days, and ceased after 52. In the field, the beetles usually left the logs over a period of two months or more, and at the peak, the number emerging each day was roughly correlated with temperature. The sexes were about equal in numbers. Emergence of adults from eggs laid in spring began after mid-July and reached a maximum about mid-August. The average number of young beetles per family emerging from 14 logs was 15·6, only about a quarter of the average number of eggs laid by a female. After leaving the bark, the adults may enter logs to breed within 24 hours, but large numbers feed first on healthy elms [*cf.* **27** 68] ; adults from overwintering larvae do so in June, and those from eggs laid in spring or early summer in August and September. Adults were found to have flown or been blown by the wind about a mile. Some beetles had already entered hibernation on 3rd October, but many were still active and feeding at the end of October. They were active again in late April or early May, and by late May the hibernating tunnels were deserted. Observations on hibernating adults on 26th February 1938 showed that the density and percentage survival were greatest in the lower part of the tree, where the bark was thick. Low temperatures in winter killed about half the adults, but had little effect on the hibernating larvae, which were found to have a mean supercooling point of −24·4°C. [about −12°F.]. Eggs do not survive the winter, and very few individuals hibernate in the pupal stage.

Natural enemies exerted little control. The commonest predator was *Enoclerus nigripes*, Say, of which adults were observed on the bark of elms in late May and June, and eggs in galleries of *H. rufipes* in June. The larvae of this Clerid feed on those of *H. rufipes* until about the middle of August, and then move to the outer bark and construct a pupal cell. The adults emerge after mid-September and hibernate. The pupal stage lasted 12–13 days at 24°C. [75·2°F.] in the laboratory. *Platysoma coarctatum*, Lec., is fairly common in bark

containing old galleries of *H. rufipes*, and eggs were found in June in the larval tunnels. Pupation took place in late August in the egg galleries. This Histerid is believed to be predacious on *H. rufipes*, as also is *Lonchaea polita*, Say, which pupates in the egg galleries.

Spathius canadensis, Ashmead, is the commonest parasite of *H. rufipes* [*cf.* **25** 37 ; **26** 14], but usually parasitised only 5–10 per cent. of the larvae in a given family. Prepupae of an undescribed Pteromalid were observed overwintering in the bodies of adults of *H. rufipes*, but they were uncommon. About 80 per cent. of the adults of each sex of the Scolytid examined contained Nematodes in the haemocoele, but in only a few was there any diminution in the size of the gonads that might be attributed to them. Mites were common in the galleries, and those found attached to adults were a species of *Uropoda* and *Pediculoides dryas*, Vitzthum. The latter is apparently parasitic, but the former is not. Notes are given on other insects found under the bark of elms.

Ginsburg (J. M.) & Perlgut (L. E.). **Chemical Reactions of Lead Arsenate-Lime-Sulfur Sprays.**—*Bull. N.J. agric. Exp. Sta.* no. 655, 20 pp., 2 figs., 20 refs. New Brunswick, N.J., 1938. [Recd. 1939.]

The following is substantially the author's summary : Laboratory experiments were conducted with spray mixtures of lead arsenate and lime-sulphur in order to study the chemical reactions involved in the formation of soluble arsenic, and to ascertain the extent to which calcium hydroxide and skim milk can be depended on to prevent its formation. Acid lead arsenate, at the rate of 3 lb. per 100 U.S. gals. was used alone and combined with various dilutions of lime-sulphur, various concentrations of calcium hydroxide, and skim milk, the mixtures being shaken for 24 hours. The filtrates of the mixtures were analysed for soluble arsenic, total sulphur, sulphur as sulphide, thiosulphate and sulphate, and calcium. In a similar manner, the different components present in lime-sulphur were tested separately with lead arsenate. By the same methods filtrates from different spray mixtures, exposed in thin films on shallow plates out of doors, were analysed. The dried residues of the mixtures were also analysed for sulphur and calcium.

The results suggest the following conclusions : Lime-sulphur reacts with lead arsenate in two ways. At low dilutions, such as 1 : 50, no appreciable increase in soluble arsenic takes place. At dilutions of 1 : 100 or higher, large amounts of soluble arsenic are formed. Of the lime-sulphur components, the sulphides, especially hydrogen sulphide, readily reacts with lead arsenate to form soluble arsenic, whereas the thiosulphate, sulphate and sulphite of calcium do not produce appreciable increases of soluble arsenic. Lead arsenate causes a large proportion of the sulphur to precipitate from solution and accumulate as free sulphur in the residue. These changes are prevented when calcium hydroxide is added to the mixture. Calcium hydroxide, when used in concentrations equal to approximately twice the proportion of lead arsenate present in the lime-sulphur spray, prevents the formation of soluble arsenic. Skim milk, used as spreader, does not by itself materially affect the spray mixtures of lime-sulphur and lead arsenate,

but when mixed with calcium hydroxide, it prevents the formation of the black lead sulphide, forming, instead, lead proteinate. This reaction produces a grey residue instead of the usual black residue.

Entomological Investigations.—*Rep. Dep. Agric. St Lucia 1937* pp. 23–25. St. Lucia, 1939.

This report on insect pests in St. Lucia in 1937 includes a section by R. G. Fennah dealing with work on *Diaprepes* spp. on *Citrus* [*cf. R.A.E.*, A **26** 402, 751]. Females did not oviposit on *Gliricidia* in fields of limes during 1937, although in other years they have used it freely. A small outbreak of *Cholus* (*Polyderces*) *zonatus*, Swed. [*cf.* **20** 14] occurred on coconut during the year, and infestation by Coccids was rather high on palms in the areas most affected by the prevailing dry conditions. Small black spots, similar to those caused by the oviposition of *Frankliniella insularis*, Frankl., in St. Vincent [**26** 175], were observed in 1936 on banana fruit from certain districts, but their occurrence is now infrequent, following the removal in 1937 of flowering undergrowth, particularly leguminous plants, from the fields in the affected areas.

Papers noticed by Title only.

Jannone (G.). **Aspetti dell'entomologia applicata nei territori confinanti con l'A.O.I. e rapporti con l'agricoltura di quest'ultima.** [Aspects of Applied Entomology in the Territories adjoining Italian East Africa and their Relation to Agriculture in the latter (a general survey).]—*Agric. colon.* **33** no. 8 pp. 476–485. Florence, 1939.

Candura (G. S.). **Cause d'insuccessi nella lotta invernale contro le cocciniglie dei fruttiferi. Tre anni di sperimentazione nella Venezia Tridentina.** [The Causes of Failure in Winter Work against Coccids attacking Fruit Trees. Three years of Experiments in the Trentino, Venetia.]—*Italia agric.* **74** (1937) no. 10 repr. 12 pp., 3 figs. Rome, 1938. [Recd. 1939.] [*Cf. R.A.E.*, A **26** 350.]

Caldwell (N. E. H.). **The Control of Banana Rust Thrips** [*Scirtothrips signipennis*, Bagn., in Queensland].—*Bull. Dep. Agric. Stk Qd Div. Pl. Ind.* no. 16 (N.S.), 73 pp., 9 figs., 3 maps, 1 fldg table, 12 refs. Brisbane, 1938. [Recd. 1939.] [See *R.A.E.*, A **27** 329.]

Mendes (L. O. T.). **Segunda contribuição sôbre a ocorrência da "traça da batatinha"** (*Gnorimoschema operculella* **Zeller**) **(Lepidoptera-Gelechiidae) no Estado de São Paulo.** [Second Contribution on the Occurrence of the Potato Moth, *Gnorimoschema operculella*, in the State of São Paulo, Brazil.]—*Bol. téc. Inst. agron. Estado S. Paulo* no. 52, 36 pp., 15 pls., 7 refs. Campinas, 1939. [*See R.A.E.*, A **27** 289.]

Back (E. A.) & Cotton (R. T.). **Stored-grain Pests.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1260 (revd.), 47 pp., 64 figs. Washington, D.C., 1938. [Recd. 1939.] [*Cf. R.A.E.*, A **10** 594 ; **19** 494.]

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Printed under the authority of HIS MAJESTY'S STATIONERY OFFICE
by the South Essex Recorders, Ltd., Ilford.

(107) Wt. P16/8073 1700 2/40 S.E.R. Ltd. Gp. 432.